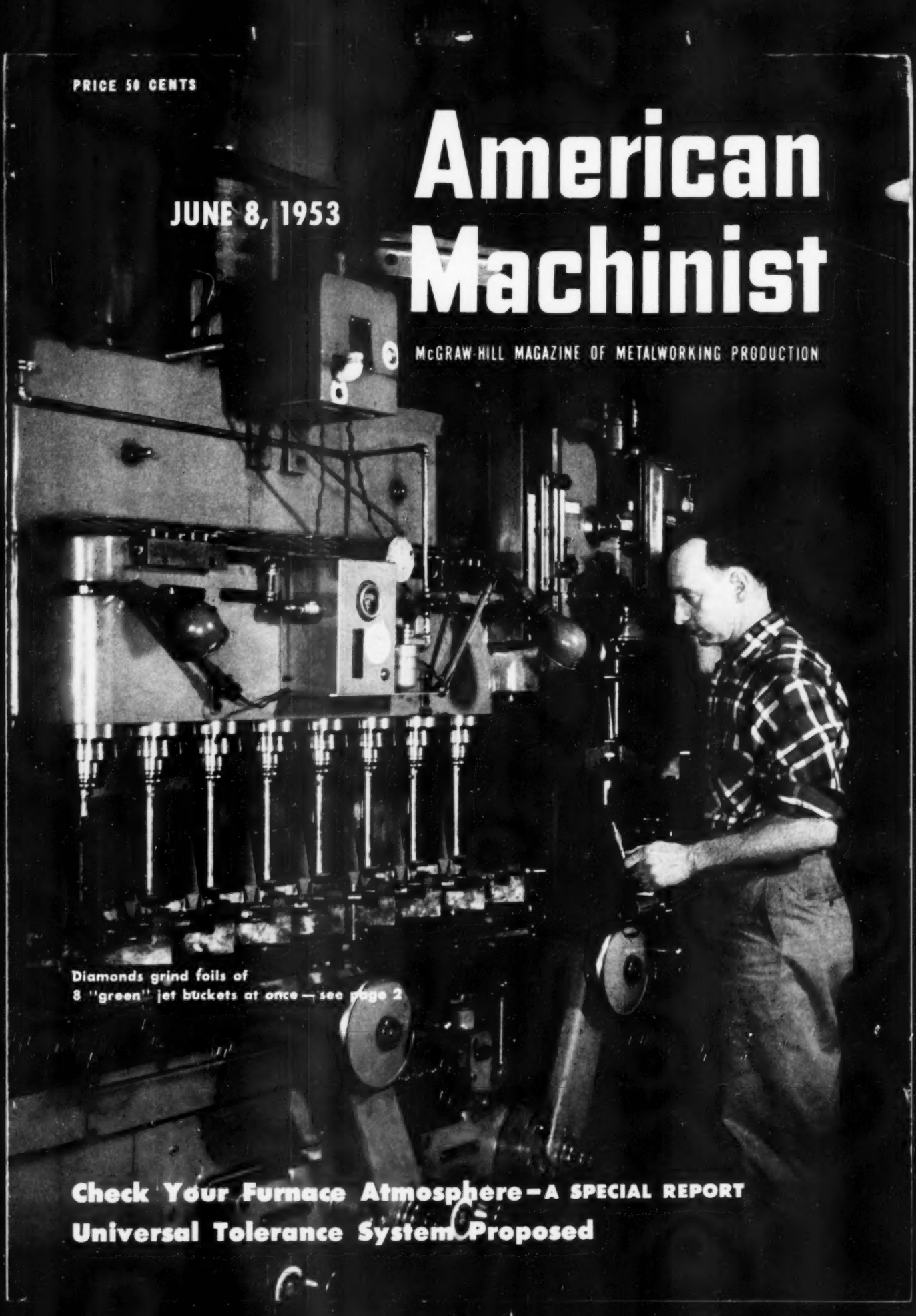
PRICE 50 CENTS

American Machinist

JUNE 8, 1953

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION



Diamonds grind foils of 8 "green" jet buckets at once — see page 2

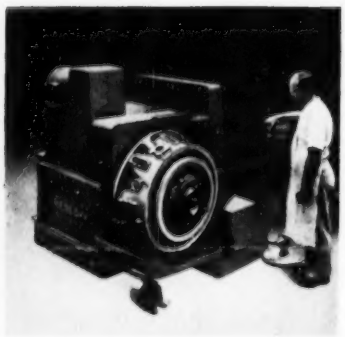
Check Your Furnace Atmosphere — A SPECIAL REPORT

Universal Tolerance System Proposed

Jet Aircraft Part Gets

40 BORIZING OPERATIONS

in 12 minutes



MAKING DIFFICULT JOBS easy is a Heald specialty. Here's a typical example.

Eight circular flanges on this jet-engine compressor frame require *five* individual borizing operations to very close tolerances. Yet with the Heald way-type Bore-Matic shown at the left, the entire job—including loading and unloading—takes only 12 minutes per part.

The number 3 size way leg unit, with rotary fixture mounted low on the base, simplifies loading of the heavy, awkward part. The rotary fixture is manually indexed and positioned by an air-operated locator pin with foot-valve control. Operations performed include chamfering, turning, facing, forming and blending two radii. Borizing operations at each of the eight positions are completely automatic.

Remember, when it comes to precision finishing, it pays to come to Heald.

Internal and Rotary Surface Grinding Machines and Bore-Matics

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THE HEALD MACHINE COMPANY

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MAGAZINE OF METALWORKING PRODUCTION

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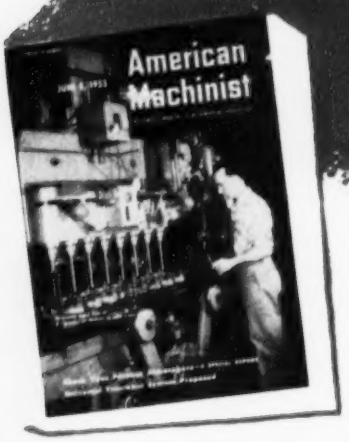


Chips and QUIPS

Foil Grinder . . . Foils of jet turbine blades are ground eight at a time in an 8-spindle Cincinnati Hydrotel at Kennametal Inc, Latrobe, Pa. A 360° tracer in contact with a master blade guides the 2-in.-dia diamond wheels, as shown on our cover. Blades are of Kentanium, a cemented titanium carbide produced by powder metallurgy. They are compacted and presintered, then machined to close tolerances in the "green" state. After final sintering, no further grinding of foils is required, but blade roots must be finish-ground because of the critical fit. The material resists oxidation, withstands thermal shock, and retains strength to 1800 F and above.

New Tolerances . . . F W M Lee, managing director of Pilot Plug Gage Co, Coventry, England, proposes a new system of standard tolerances in our lead article. He says it would simplify drafting practice and greatly reduce the number of plug gages required. The system is easily memorized, can be used both in the US and Britain.

Nylon . . . Nylon is being applied to bearings, collets, wear pads, spindle liners, rollers, and guides. From Polymer Corp we got the case studies, with pictures, plus the action and wear.

Rumania . . . We get a bit tired of the current paper campaign for peace from behind the Iron Curtain, but just this once more we bring you examples of the latest machine tools there. This time it's case studies from the infant Rumanian machine-tool industry, developed to ease the strain on USSR.

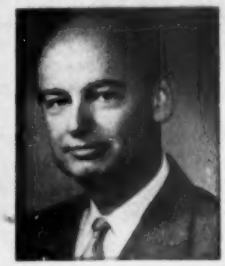
Understanding Atmospheres . . . H M Webber and A G Hotchkiss of GE are about to take their bows for "Protective Atmospheres", a book to be published the middle of this month by John Wiley Sons, Inc. From it, we bring you, as our Special Report, the data having to do with causes of trouble with protective atmospheres and appropriate corrections. One feature is a check sheet listing potential troubles, tests to find the troubles, and the remedies.

For Jobs . . . DuMont TV and Rensselaer Poly have worked out a job classification and upgrading program. It analyzes potential abilities, helps men develop maximum capabilities and earning power. Associate Editor Stocker describes planning and the system of "profile development".

Tooling . . . To reduce wrinkles in rubber-pad forming, Convair is using steel master parts which fit over the work and form block on the press bed. Masters are aligned with the form blocks by locating pins. We tell about it in a page . . . Associate Editor Ashburn takes a spread to tell how DeLaval machines split steel bearings on a turret-lathe arbor. It's a variant of the old ring trick, with a locking ring at the center initially, then two on the machined shoulders. The idle ring rides the arbor so work need not be removed between operations. . . There's also a spread of Talented Tooling including an automatic diehead closer, a shop-designed miller for turbine blades, a follower on a lathe setup, and a broaching fixture.

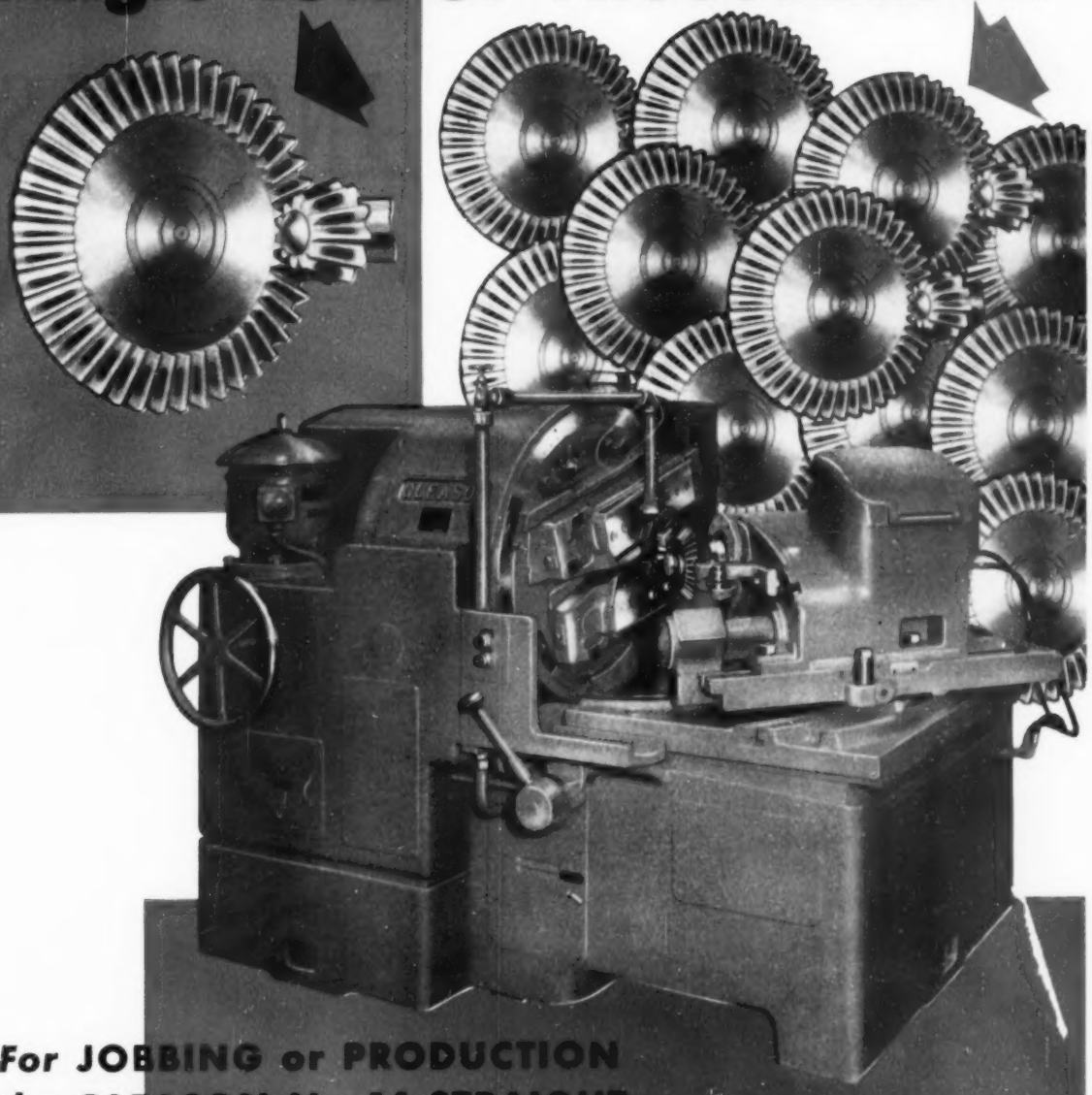
Coming . . . June 22 *AM* will include a Special Report on the last US steam-locomotive plant, the backshop of the Norfolk & Western at Roanoke, Va. Sixty steam locomotives have been built there in the last four years. . . There are also articles on gages for regrinding hobs, a stripper for compound dies, on manufacture of glass-and-metal tubes, and instalment III of the Monarch series on machinability. Our cover is a striking forging shot in full color.

H M WEBBER is one of the two authors of our special report for this issue. His job is as application engineer on protective-atmosphere furnaces and atmosphere-gas producers at General Electric Co, and he is concentrating his efforts on furnace brazing, sintering, and bright annealing. He's a veteran of the GE Test Program, which he started after graduating from the University of Colorado (1926) in electrical engineering. Mr Webber is well known as an authority on protective atmospheres and on furnace brazing. He is a New York State professional engineer and a member of ASM, AWS, and the Schenectady Photographic Society (past president).



ALLEN G HOTCHKISS is the second author of the report on protect've atmospheres, and is also a GE veteran and Test-Program graduate. He has a BS in electrical engineering from Kansas State College (1926), and holds four patents in his field. He has had experience in GE's Industrial Heating Department; his current specialty is development and design of equipment for atmosphere heating and wire enameling, on which he has written many articles. He is a professional engineer of New York State, a member of ASM and ASTM, and a colonel in the Reserve.

Single Lots or Thousands...



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It is universal within its range . . . is easily set up and changed from one job to another . . . equipped with double track cam for roughing and finishing . . . handles gears up to 24" pitch diameter in large or small quantities.

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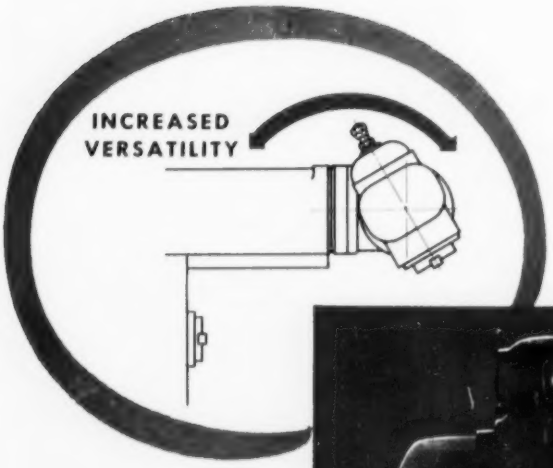
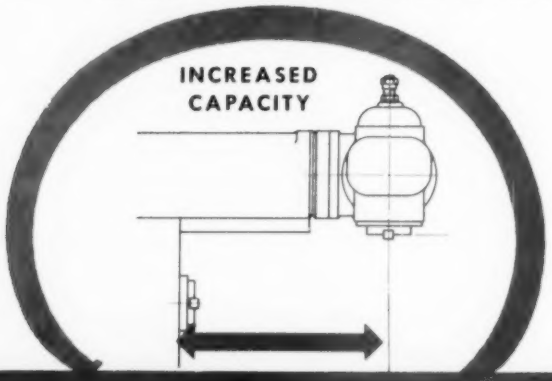
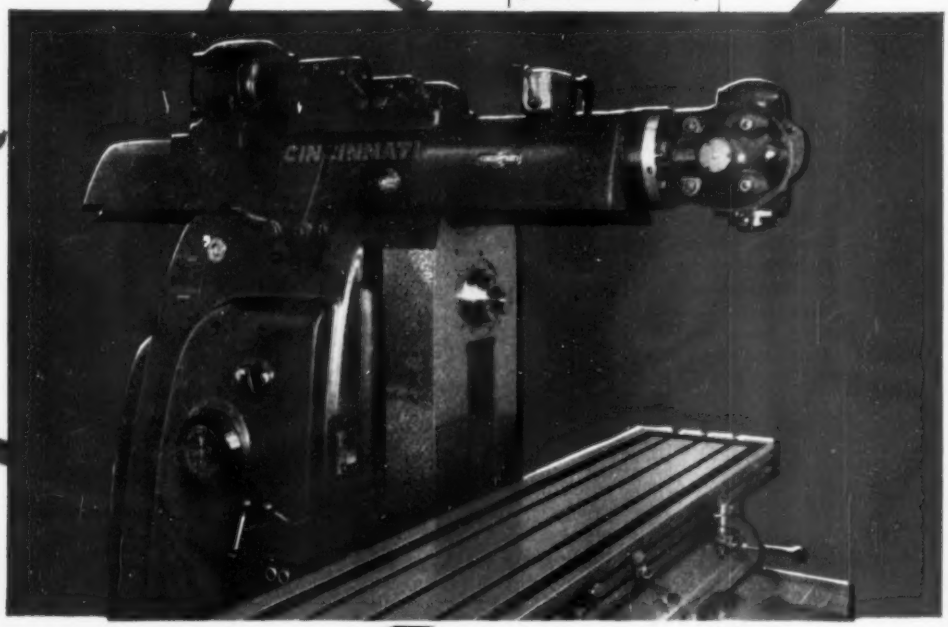
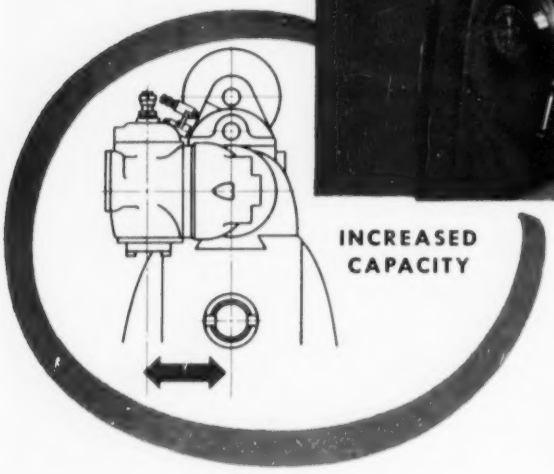
600% INCREASE



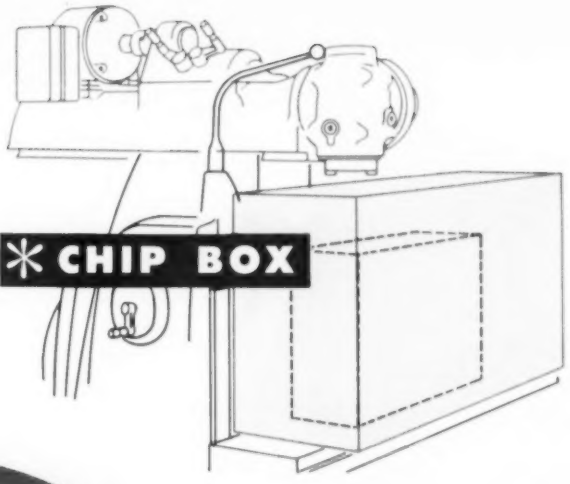




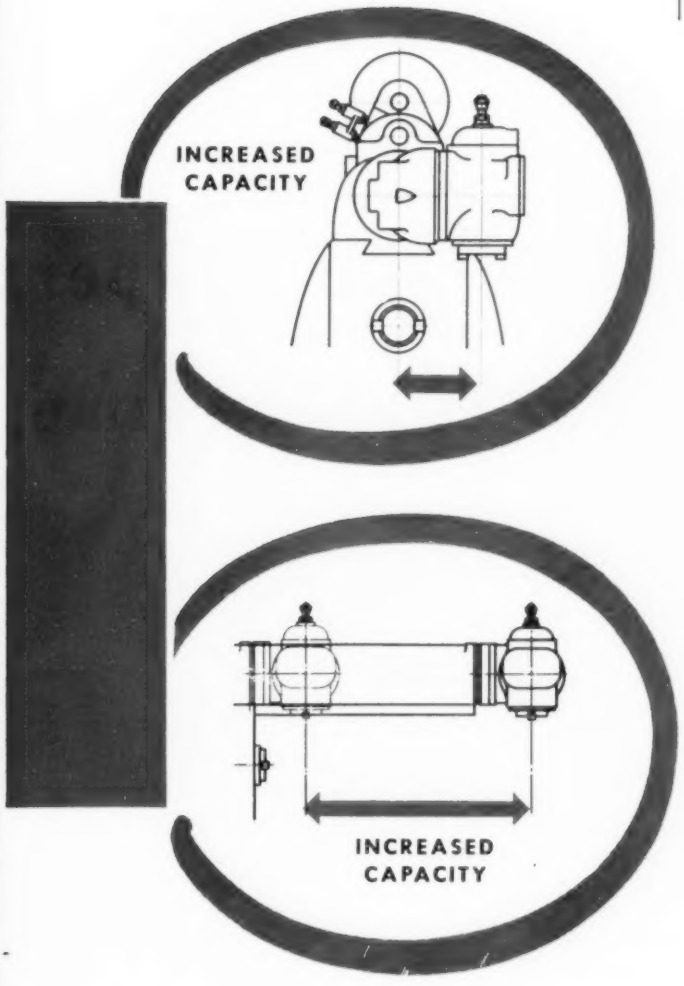
CINCINNATI No. 5 Plain High Power Dial Type Milling Machine equipped with Motor Driven Universal Milling Overarm Attachment.



IN VOLUME OF *CHIP BOX



Color box indicates increased cutting range which can be obtained on a CINCINNATI No. 2MI by replacing the overarm with a Motor Driven Universal Milling Overarm Attachment.



"I could do that job if my machines had a little more range and versatility." This familiar statement indicates a condition that can be readily changed on your CINCINNATI Knee Type Milling Machines by simply equipping them with Motor Driven Overarm Attachments. ¶ This type of attachment is a self-contained motor driven unit mounted in the standard overarm ways. All advantages of the CINCINNATI overarm construction are retained, and there is no interference whatever for conventional setups. The permanently mounted universal milling head at the front end reduces cost by eliminating the set-up time required for attachments driven from the machine spindle. There are nine speeds independent of the machine, and you have a choice of two series. ¶ A few examples of the ways in which CINCINNATI Motor Driven Overarm Attachments increase the range and versatility of CINCINNATI Milling Machines are illustrated here. There are two sizes of these attachments: 2 hp for No. 2ML, Nos. 2 and 3MI and Dial Types; 5 hp for Dial Types and High Power and Dual Power Dial Types. Compared to a conventional setup, where position of the cutter is not changed on the arbor, the attachment increases volume of *Chip Box 400% to 600%. You may obtain more information by writing for publication No. M-1661-1.

THE CINCINNATI MILLING MACHINE CO.
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* On every milling machine table is an imaginary "Chip Box" in which chips can be cut throughout its entire volume.

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MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

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From here to finished

36 Type Gear Shaper

Cuts Production Time

Fewer Machines... Greater Accuracy... Lower Costs... these are the results in a plant where two modern 36-Type Fellows Gear Shapers are doing the work of *five* ordinary machines in cutting the spur gears specified in the production chart at the right... producing more work of greater accuracy and cutting operating costs into the bargain.

The 36-Type can be adapted to a wide range of work... spur or helical gears, external or internal, herringbone gears as shown in the illustration, splines, and irregular shapes of all sizes up to and including 36" pitch diameter and 6" face width. All these can be generated on this Gear Shaper by the Fellows Method.

You can find out what the 36-Type Gear Shaper can do in your plant by talking with a Fellows Representative.

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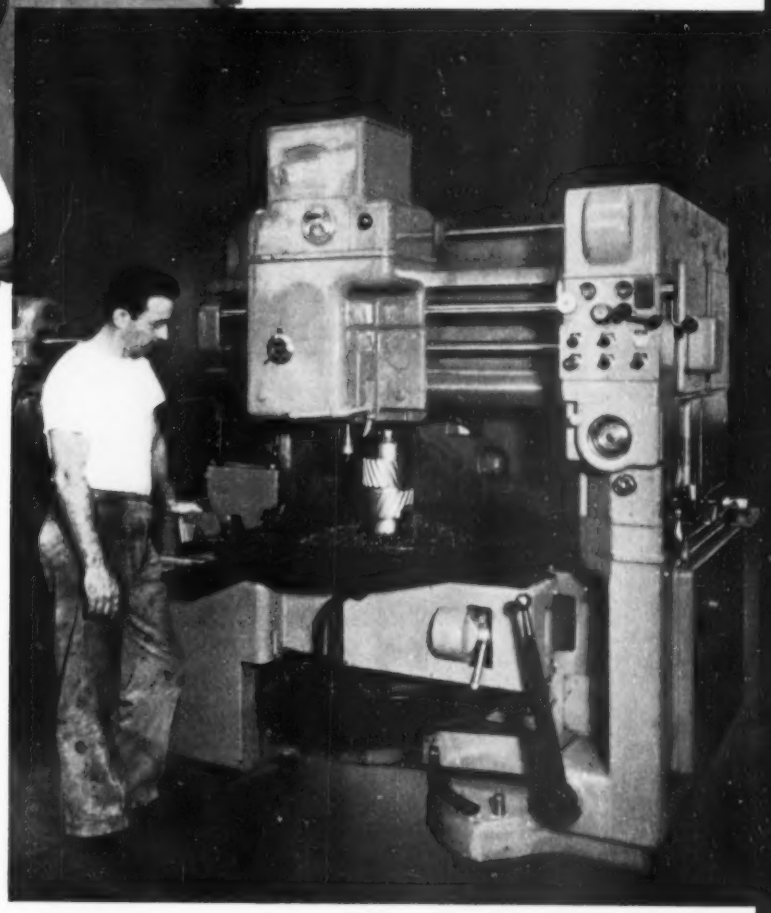
The FELLOWS METHOD
...in action!

gear



By 65%

PRODUCTION PERFORMANCE

LARGE BRONZE SPUR GEAR (TOP)

Material . . . . . High tensile bronze #3
Face width . . . . 4 inches
Pitch diameter . . 34.000 inches (Special)
No. of teeth 138
Diametral pitch . 4
Production Time . 6 hours

Production Time with 36-Type Gear Shaper . . . 1 hr., 55 min.

STEEL SPUR GEAR

Material . . . . . Steel casting DW-19
Face width . . . . 3 inches
Pitch diameter . . 22.250 inches
No. of teeth 89
Diametral pitch . 4
Production Time . 10 hours

Production Time with 36-Type Gear Shaper . ... 2½ hours

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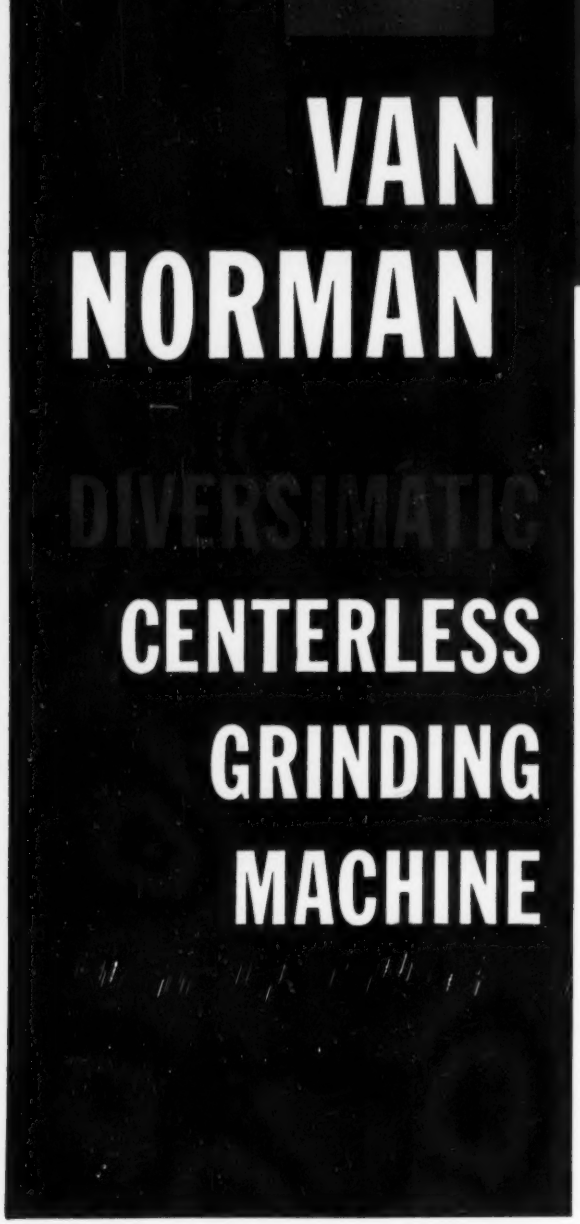
Announcing

THE NEW

VAN NORMAN

DIVERSIMATIC

CENTERLESS GRINDING MACHINE



. . . another addition

The new Van Norman *Diversimatic* centerless grinding machine incorporates many outstanding, exclusive advantages that result in more work output per operator, per work shift.

This rugged, precision-built, heavy-duty centerless grinder enables you to perform three centerless grinding jobs with practically no change-over time. It's a standard centerless grinder for ordinary throughfeed work . . . a standard grinder for infeed jobs . . . and equipped with a Crush Forming attachment, it forms grinds and does profile work.

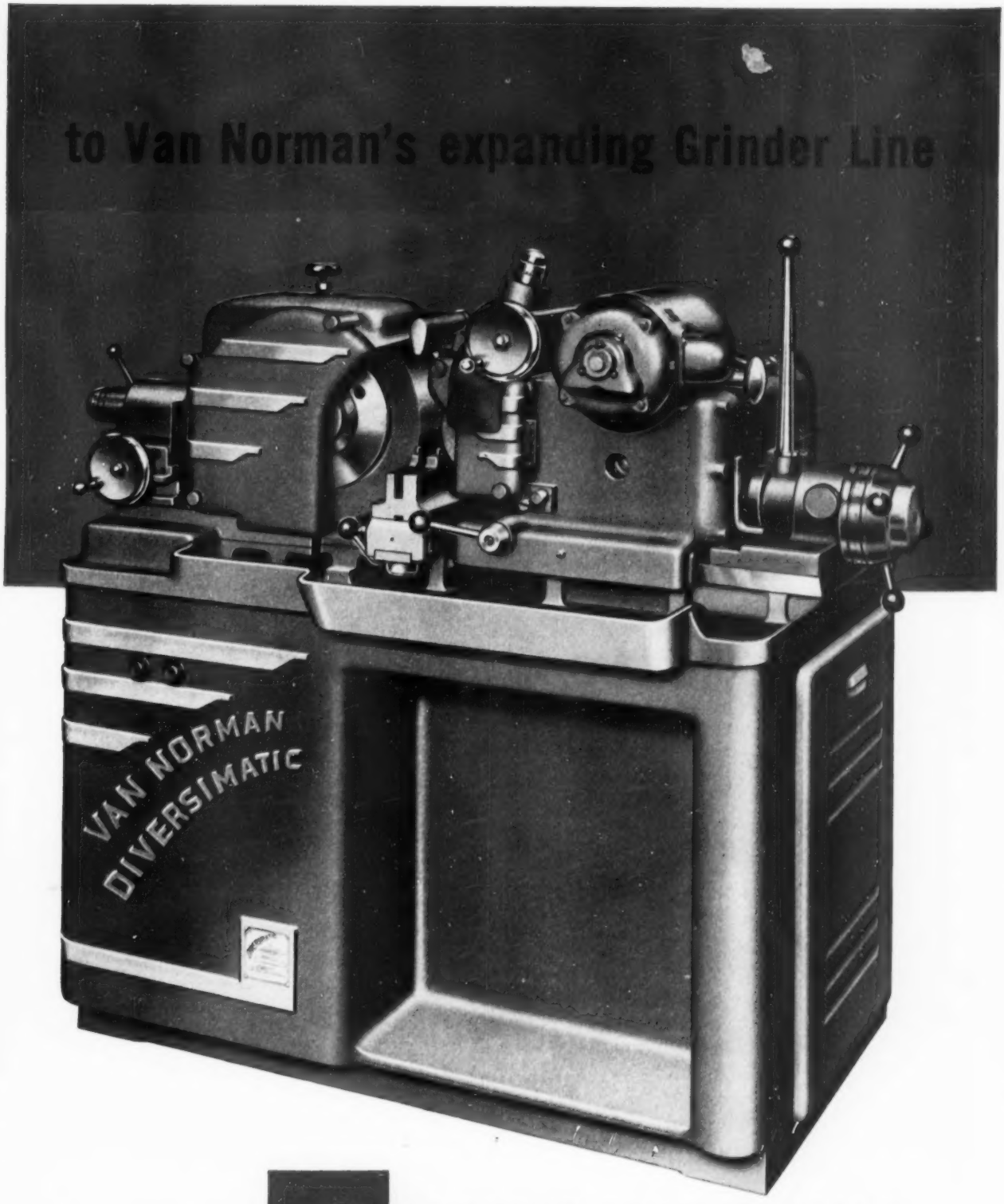
COMPARE THESE OUTSTANDING VAN NORMAN DIVERSIMATIC FEATURES

- Special, easily removable grinding wheel, spindle quill, with combined double-row super precision ball and roller bearings, sealed and lubricated for life assure trouble-free operation
- Spindle requires no warm-up period
- Combination straight and contour grinding wheel dresser.
- Straight screw-type regulating wheel dresser
- Grinding wheel diamond constantly flushed from below with coolant during wheel dressing
- Infinitely variable ¼ h.p. regulating wheel drive, 30 to 300 r.p.m.
- Large 1⅞ inch 4 thd. Acme Infeed Screw with full length split type nut to compensate for wear
- Work-Rest adjustable for position; may be fixed across the ways or made to feed in and out with the regulating wheel

Get the full facts on the Van Norman Diversimatic Centerless Grinder. See for yourself how this versatile grinder can cut your grinding costs on small shafts, formed shapes, parts of two or more diameters or special contours.

*Van Norman Diversimatic acquired from Diversified Metal Products Co.

to Van Norman's expanding Grinder Line



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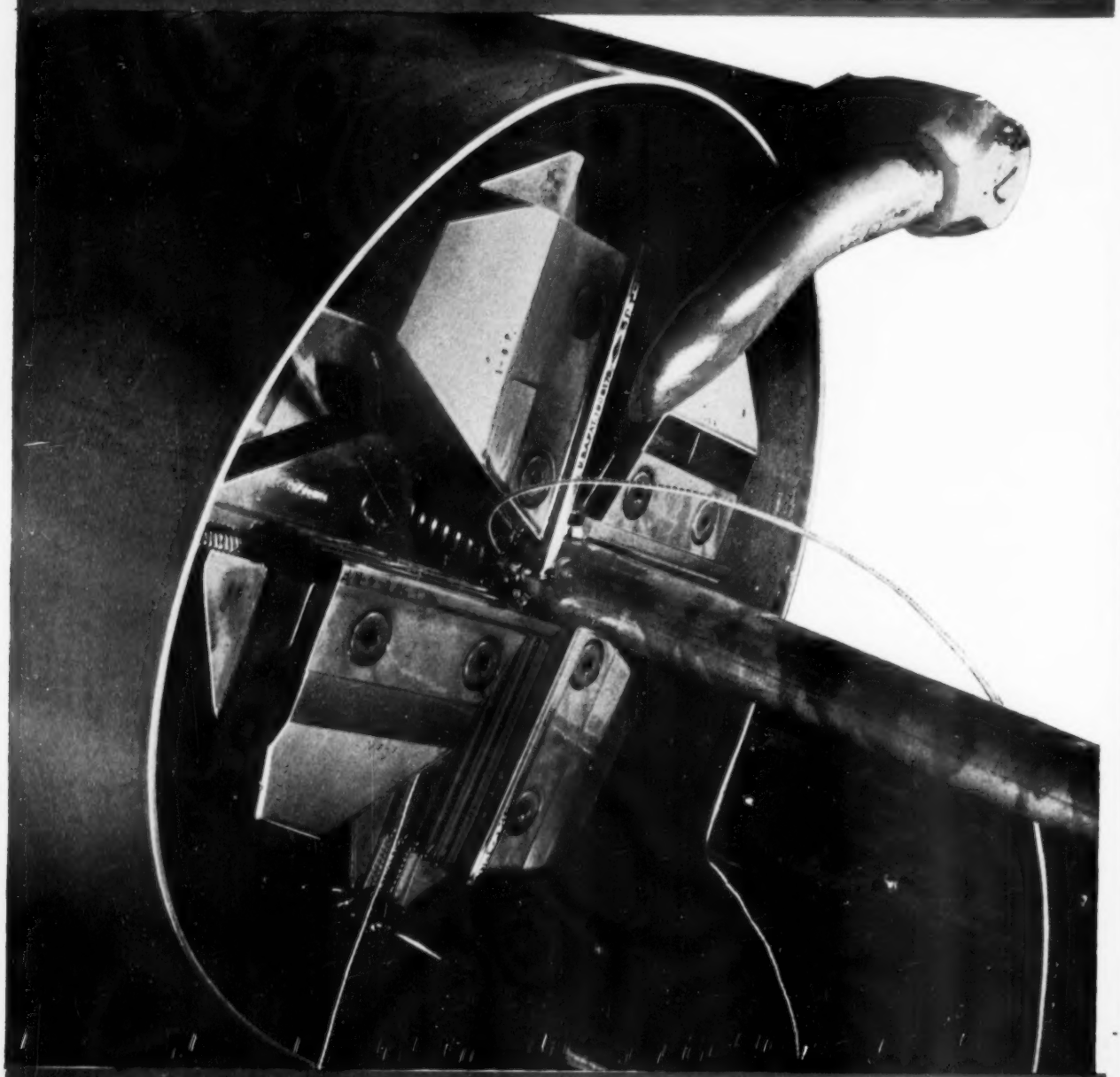
SPRINGFIELD 7, MASSACHUSETTS, U. S. A.

How The Slaysman Company



LANDIS *Machine* COMPANY

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF

Reduced Threading Time 97%

MR. ALEXANDER S. SMICK, President of the Slaysman Company, large machine shop and parts sub-contractor in Baltimore, said in a field interview: "Our LANDIS machine reduced threading time on this particular job from 2 hours to 4 minutes and made savings on every other job run on it."

The "particular job" referred to by Mr. Smick was a contract involving the cutting of a 1" diameter 5 pitch Acme thread 29" long on C1141 steel to a Class 3 fit. Original production plans were to generate the thread by milling. At the same time, even though the specifications and the hardness of the material seemed to preclude other methods, we were asked if we could suggest a more efficient threading process.

Based on our recommendation after studying the thread specifications, a 1½" LANDMACO Single Head Leadscrew Machine with an extra-long carriage was installed. The LANCO threading head was equipped with centering throat chasers with a roughing and finishing thread form. Centering throat chasers produce threads concentric with the outside diameter, and eliminate the out-of-round condition that often occurs when threading extra-long workpieces. The roughing and finishing thread form chasers cut coarse pitch threads with excellent finish in one pass.

Not only did this method reduce threading time from 2 hours to 4 minutes, but it also produced a very economical 50 pieces between chaser grinds. This is particularly impressive when it is remembered that the thread was 29 inches long and the hardness of the material threaded was near the limits of machineability.

This is not a single outstanding case. While results here were somewhat unusual because of the size of the saving, many other LANDIS machines have made significant savings producing all types of threads. Perhaps we may help YOU make similar economies in your Thread Production.

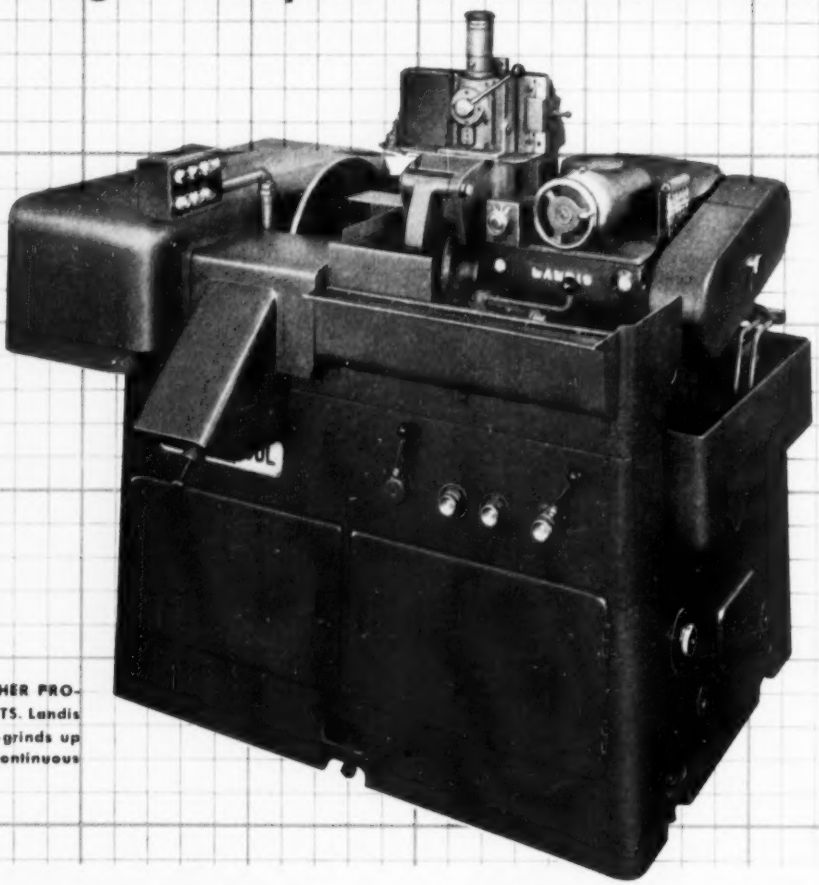
50TH ANNIVERSARY

WAYNESBORO PENNSYLVANIA

THREAD GENERATING EQUIPMENT

JOB ENGINEERED For Lower

LANDIS Single Purpose Production Grinders



JOB ENGINEERED FOR HIGHER PRODUCTION AND LOWER COSTS. Landis Jet Blade Contour Grinder—grinds up to 5 surfaces in one continuous operation.

Landis Single Purpose Grinders are Job Engineered to meet special production problems. The need may be for reduced handling time, greater precision, automatic operation or an automatic cycle for unskilled operators. The machines illustrated here are examples of Landis Job Engineered Grinders that are solving problems such as these.

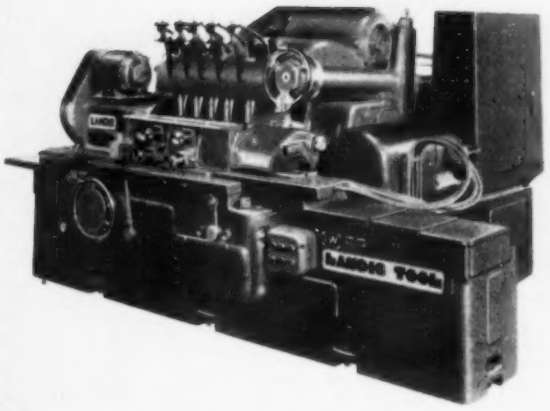
If you are thinking about reduced grinding costs, it will pay you to check with Landis. We will be pleased to give you tooling suggestions and production estimates based on your work prints.

165

LANDIS
precision grinders

Unit Grinding Cost!

JOB ENGINEERED FOR LESS WORK HANDLING



Multiple Wheel Grinder

Grinds up to 10 diameters in one operation. For infeed grinding of concentric diameters in one operation—straight, tapered, profiled.

JOB ENGINEERED FOR SUPER-PRECISION

Concentric Grinder

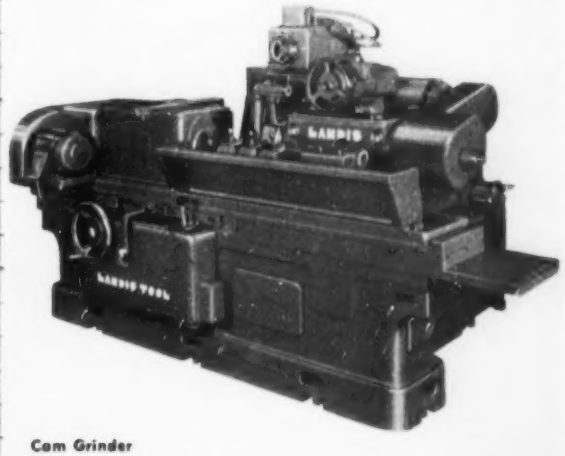
Automatically grinds external surface concentric to bore. For high production of straight, profiled, tapered surfaces to precision tolerances.

JOB ENGINEERED FOR AUTOMATIC OPERATION

Valve Face Grinder

Automatic operation triples man-hour output. Automatic loading, automatic grinding cycle and automatic unloading give low cost production.

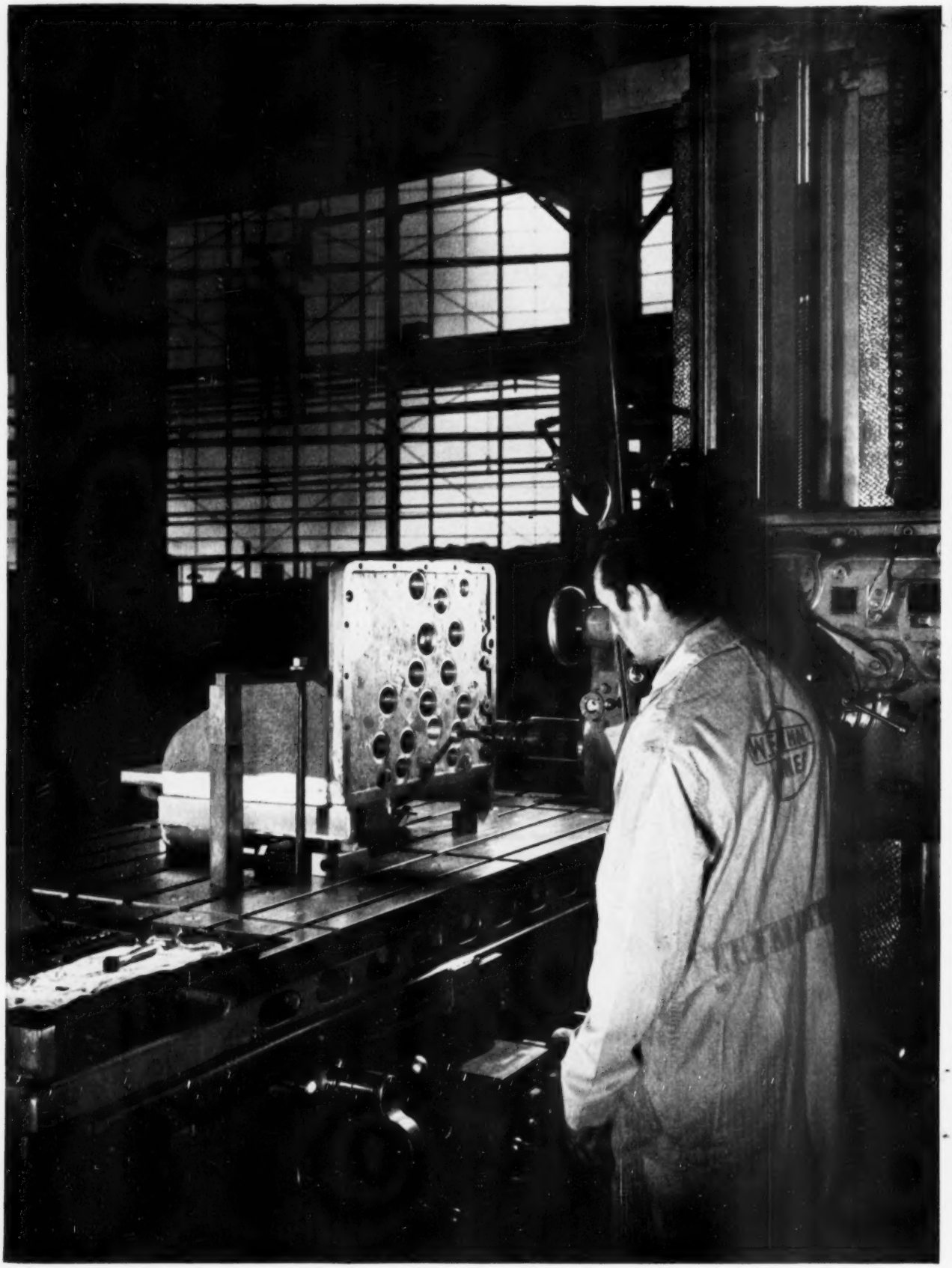
JOB ENGINEERED FOR CAM CONTOUR GRINDING



Cam Grinder

Automatic cycle permits one operator to handle several machines. Automatic grinding cycle and automatic dressing cycle require attention only for loading and unloading.

LANDIS TOOL COMPANY / WAYNESBORO, PA., U.S.A.



Hairsplitting

on a mass production basis!

This workpiece is positioned automatically, bored to limits within .0002″, yet handled on a production basis. It's a routine job for the versatile G&L 340-T Horizontal Boring, Drilling and Milling Machine with Automatic Electric Positioning Device.

You can increase the efficiency of boring, drilling or milling operations with this ultra-precision machine. Because of its open construction and outstanding rigidity, the G&L 340-T allows you to handle either large or small work with equal precision on both production and custom run jobs. It's extremely flexible. With it, you can perform multiple operations from a single setup . . . maintain close tolerances and parallelism even though table is fully extended.

Featuring 45 easily selected speeds and 36 feeds, this standard model table-type machine delivers 20 hp, has a 4″ spindle, offers a choice of three basic table and saddle arrangements. Standard bed length is 72″, headstock travel on the column is 36″. Cross-feed of its 36″ x 72″ table is 60″. Larger bed, column and table sizes are also available.

What's more, these versatile machines can be equipped with the G&L Automatic Electric Positioning Device. This unit eliminates many time-consuming hours for final hand adjustments for locating work. That's because it automatically controls table and headstock movements to precise, pre-determined settings.

For complete information, see your G&L representative or write ———

GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Open Side Planers, Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools.

Photo courtesy of
The W. F. & John Barnes Co.

VK HIGH SPEED STEEL

THREAD MEASURING WIRES

...basic tools in a universally accepted method of checking screw threads

VK Set No. 20 HS Thread Measuring Wires, accurate to ±.000025" for 20 common pitch Unified and American screw threads, 6 to 36 threads per inch.

The three-wire method is probably the best known and most widely accepted system of measuring pitch diameter of screw threads. Equipment required includes only a set of VK Thread Measuring Wires of proper diameter and an accurate measuring instrument.

Van Keuren Thread Measuring Wires have been developed over a period of many years of pioneering in the precise measurement field. They are made to National Bureau of Standards specifications, are held within .00002" for roundness, straightness and identity and to within .000025" of exact size.

VK Thread Measuring Wires are made of long-wearing, tough and beautifully finished high speed steel and are either 1⅞" or 2" in length. Every wire is subjected to the closest criteria in today's standards of accuracy.

In addition to set No. 20, shown here, VK furnishes many other standard sets as well as special wires in diameters from .001" to 1.500."

The Van Keuren Catalog and Handbook No. 35 contains 91 pages of technical and engineering information on wire measurement of screw threads. This information, compiled from many years research in the field, is available without charge by addressing: The Van Keuren Co., 173 Waltham St., Watertown, Mass.

VK

34th YEAR

THE Van Keuren CO.

173 WALTHAM STREET, WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires

No. 1 in a Series

"He who makes no mistakes does nothing"

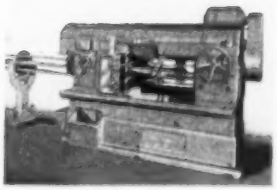
In a supposedly modern era it is sometimes claimed to be "smart business" to let a competitor take the lead and make profit from his mistakes. Obviously, if all business adhered to such a philosophy there would be no progress, if any business. "He who makes no mistakes does nothing". Cone leadership was founded — and is maintained — by active service, by doing things.

The Conomatic Carbide Development program expects to make a few mistakes. But, loss or gain, its efforts will contribute to the general benefit of all "automatic" users, users on whom all "automatic" builders are dependent.

The job illustrated compares actual production runs with HSS and 100% carbide tooling. It suggests the kind of pioneering that is being done at Cone. Full details are available.

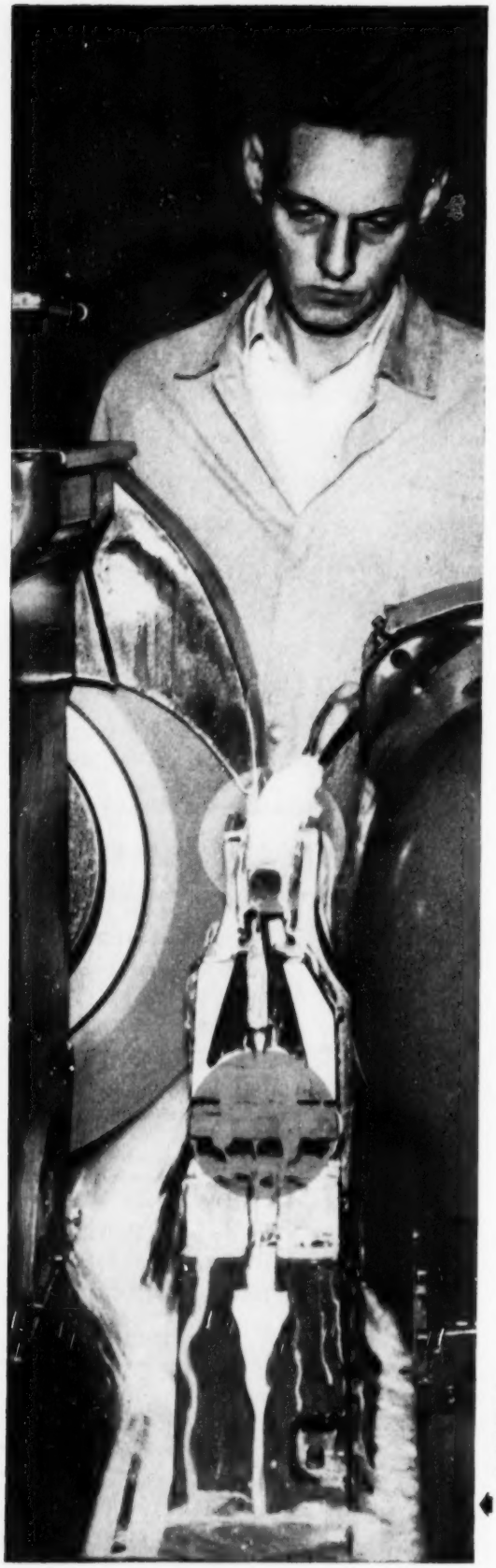
MATERIAL—1112 STEEL: Hole drilled with 1" dia. drill to 2¾" depth. OD threaded to 2" length with 1¼"— 12 chasers.

	HSS	CARBIDE
Cycle Time	90 secs.	15 Secs.
Work Spindle Speed	370 R.P.M. at 103 S.F.	1500 R. P. M. at 417 S. F.
Tool Wear	1500 pcs. per grind	5000 pcs. per grind



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.



Add the "TOUCH OF GOLD" to your grinding with the NEW Norton G BOND

Here, ready to bring you immediate benefits, is the most radically improved vitrified bond ever produced. It's the new Norton G Bond — and every time it goes to work for you it applies that "Touch of Gold" that cuts your grinding costs and increases the value of your products.

Combined with Norton ALUNDUM* abrasives, this new bond is outstanding as an aid to lower-cost grinding in many precision and semi-precision jobs.

Not only do the new G Bond wheels cover a wider range of jobs, they cut freer, cooler and faster. They hold corners better, are better for form grinding. And they do more work per wheel because they dress easier and produce more pieces per dressing.

Every one of these advantages is the result of five years of research and field-testing by Norton. And every one of them means time and money saved — the "Touch of Gold" that adds more value to your products and increases your profits by reducing your grinding costs.

How the New G Bond assures more efficient cutting action

ALUNDUM abrasive grains are held by the G Bond until they've done the most effective cutting job, then released to make way for new grains with fresh, sharp cutting edges. It's this unique ability of the new bond to hold the grains *just long enough* that keeps the wheel's grinding surface at constant peak efficiency.

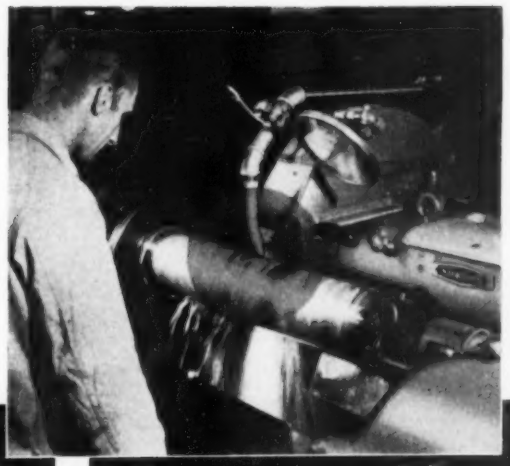
Your Norton distributor

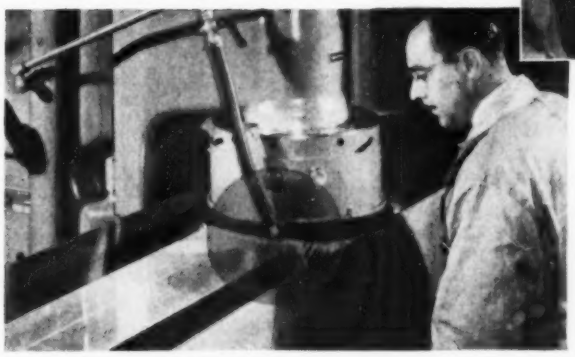
has the types and sizes of new G Bond ALUNDUM wheels you need for best results. Ask him about arranging a test in your plant. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

SOMETHING NEW IN HIS EXPERIENCE. It takes a lot of proof to convince grinding machine operators that one vitrified bond can be so much more efficient than another. Yet the new Norton G Bond has already made plenty of friends in plants throughout the country. How about getting your own shopmen's reactions to the "Touch of Gold"?

Make these 3 easy tests . . .

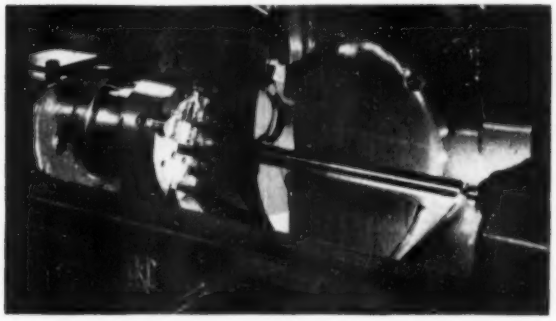
LOOK! You can see the difference in the spark stream of a Norton G Bond ALUNDUM wheel. No intermittent sparking, but a continuous, even stream that means uniform cutting action.



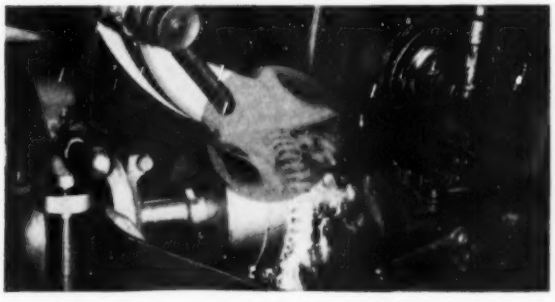


LISTEN! Norton G Bond wheels grind with the pleasant, steady swish-h-h of free, easy cutting. You hear no harsh grinding noise.

EXAMINE! On precision jobs, especially, you'll get the results you want faster. And every job you do with the new G Bond will benefit by their new, unique cutting action.



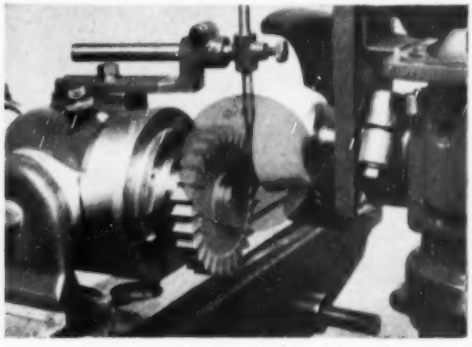
G BOND WHEELS HANDLE MANY JOBS, big or little, simple or complicated. You'll find them particularly valuable for such types of grinding as cylindrical, centerless, surface, internal, gear, tool and cutter, form and thread grinding and saw gumming.



NORTON
ABRASIVES

Making better products
to make other products better

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries



W-1480

PRODUCTION TIME

PRODUCTION DATA

PART — QUICK CHANGE CLAMP COLLAR
MATERIAL — SAE 4615.
CUTTER — ¼ dia. — 2 lip — HSS endmill.
SPINDLE SPEED — 600 rpm — (80 sur. ft./min.)
LOT SIZE — 25 to 50 pcs.
CYCLE TIME (FLOOR TO FLOOR) — 15¾ minutes.
PREVIOUS CYCLE TIME — 34 minutes.

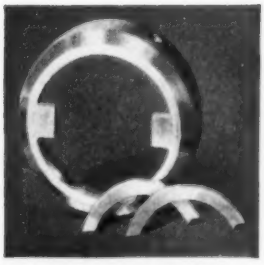
(A) 6" (B) 4⅛" (C) 3¼"
(D) — 1" ± .000 (E) — 1" ± .005 (F) ⅜"

OPERATION 1— Rough mill one side of tongue.
PROCEDURE — Offset spindle slide radius (A), set rotary head to angle (B), feed table to workpiece centerline (C to D).

OPERATION 2— Rough mill radius section between tongue.
PROCEDURE — Rotate head from angle (B) to angle (E).

REDUCED BY 53%!

Rotary Head Milling Machine simplifies method and cuts costs on still another production job



Here's the completed workpiece together with two pieces of waste.

IN production of this Quick Change Clamp Collar, considerable savings were effected by using a versatile Kearney & Trecker No. 2 Model D Rotary Head milling machine.

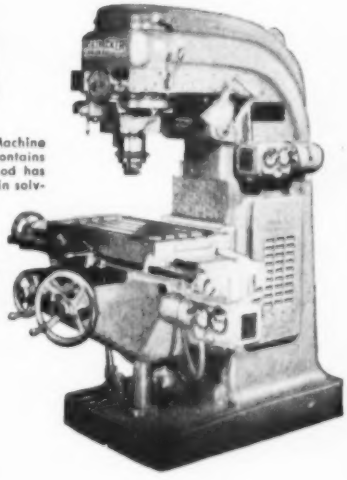
The radius of the piece was produced merely by offsetting the spindle slide and rotating the machine's head. The job was done faster, more accurately than would be possible with any other method.

Practically no other standard machine can mill these parts without a change in setup and cutters, maintain accuracy, yet complete the job in less than 16 minutes!

For details of this operation, see the diagrams below. Note: Model D's table and saddle movements are independent, will not affect the radius setting—think what that means not only to this job, but also in terms of a wider range of applications for other work.

Here's the Rotary Head Milling Machine Production Idea Booklet. It contains several examples of how this method has been found exceptionally efficient in solving production, die, forging and metal pattern milling problems. It's yours for the asking.

Address requests for booklet to Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.



KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS ®

OPERATION 3— Rough mill one side of opposite tongue.
PROCEDURE—Feed machine table from (D) to (F).

OPERATION 4— Rough mill end of tongue.
PROCEDURE—Feed machine saddle from (F) to (G).

OPERATION 5 — Rough mill second half of inner contour.
PROCEDURE — Repeat Operations 1 through 4, working area to be in the lower half of opening.

OPERATION 6— Finish mill 4⅛" dia., end of tongues to 3¼" dimension and width of tongues to 1" + .000 —.005.
PROCEDURE — Reverse sequence of Operations 1 through 5.

NO CAM WORRIES

NO CAMS TO DESIGN

NO CAMS TO MACHINE

NO CAMS TO FIND

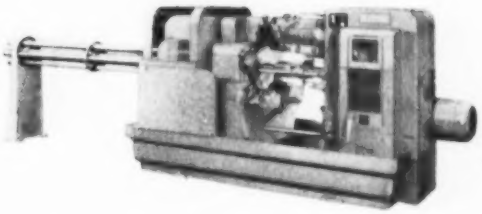
NO CAMS TO CHANGE

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY

WITH A WARNER & SWASEY 5-SPINDLE AUTOMATIC

NO CAMS TO STORE

IT'S SIMPLE TO SET UP!



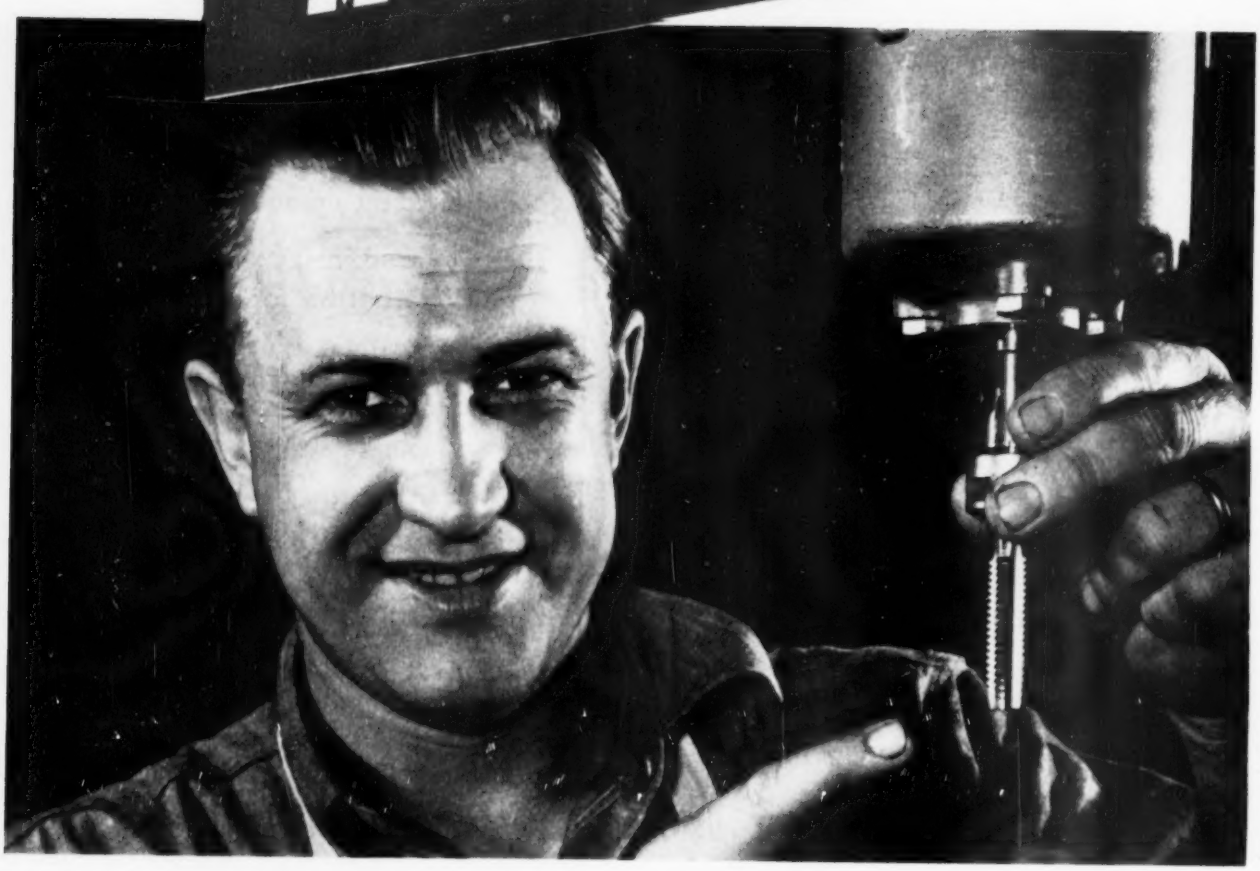
5-Spindle Bar Machines
—1¾" Standard Capacity
—2¼" Oversize Capacity
5-Spindle Chucking Machine—6" Swing

JUST make a simple setting and there you have your new feed stroke, clearly indicated on a graduated scale. Yes, it's as easy as that! All feed strokes are quickly available for both longitudinal and cross slides. No more need to sacrifice cycle time because the "right" cam is not on hand or because a cam change would take too long. You always get your exact feed stroke quickly on the Warner & Swasey 5-Spindle Automatic.

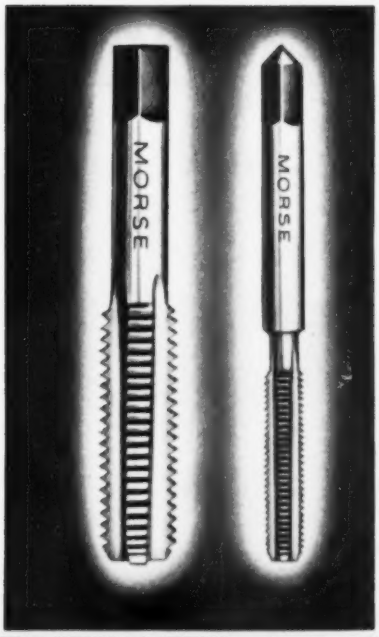
WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

"We never knew what Special-Purpose Taps could do . . . 'til we got these NEW MORSE TAPS!"

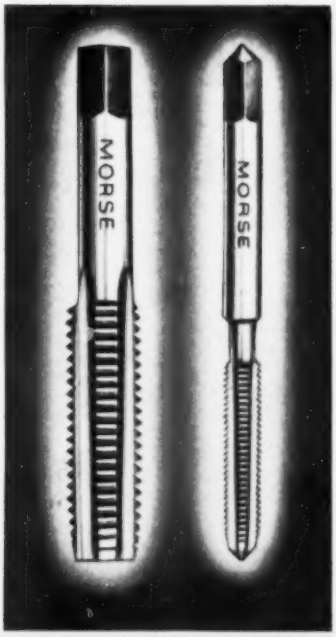


MORSE



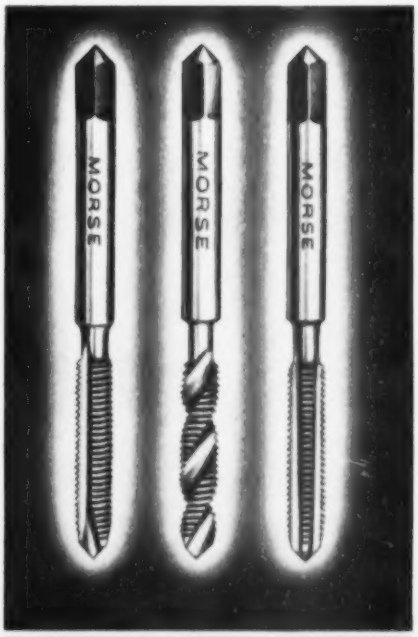
For Brass or Cast Iron

For use in these and other materials with *brittle-chip* characteristics . . . in hand, machine-screw, and taper-pipe styles. Made with radial face (0 degrees rake — see drawing at right below) and surface-treated to resist abrasion and loading. High-speed steel with commercial ground threads only, except for pipe taps (also furnished with cut threads.)



For Aluminum or Stainless Steel

For use in these and other materials with *stringy-chip* characteristics . . . in hand, machine-screw, and taper-pipe styles. Made with a 15-degree hook (see center drawing at right below) and commercial ground threads, in high-speed steel only.



Oversize Machine-Screw Taps

For use in materials like plastics or zinc alloys, *where difficult to maintain proper tapped-hole size* . . . because of the material's abrasive properties or its tendency to shrink, *after tapping*. Made in certain sizes only . . . in straight-flute . . . spiral point . . . and spiral flute styles. Regularly furnished .002" over standard commercial ground-thread limits. Surface-treated to resist abrasion.

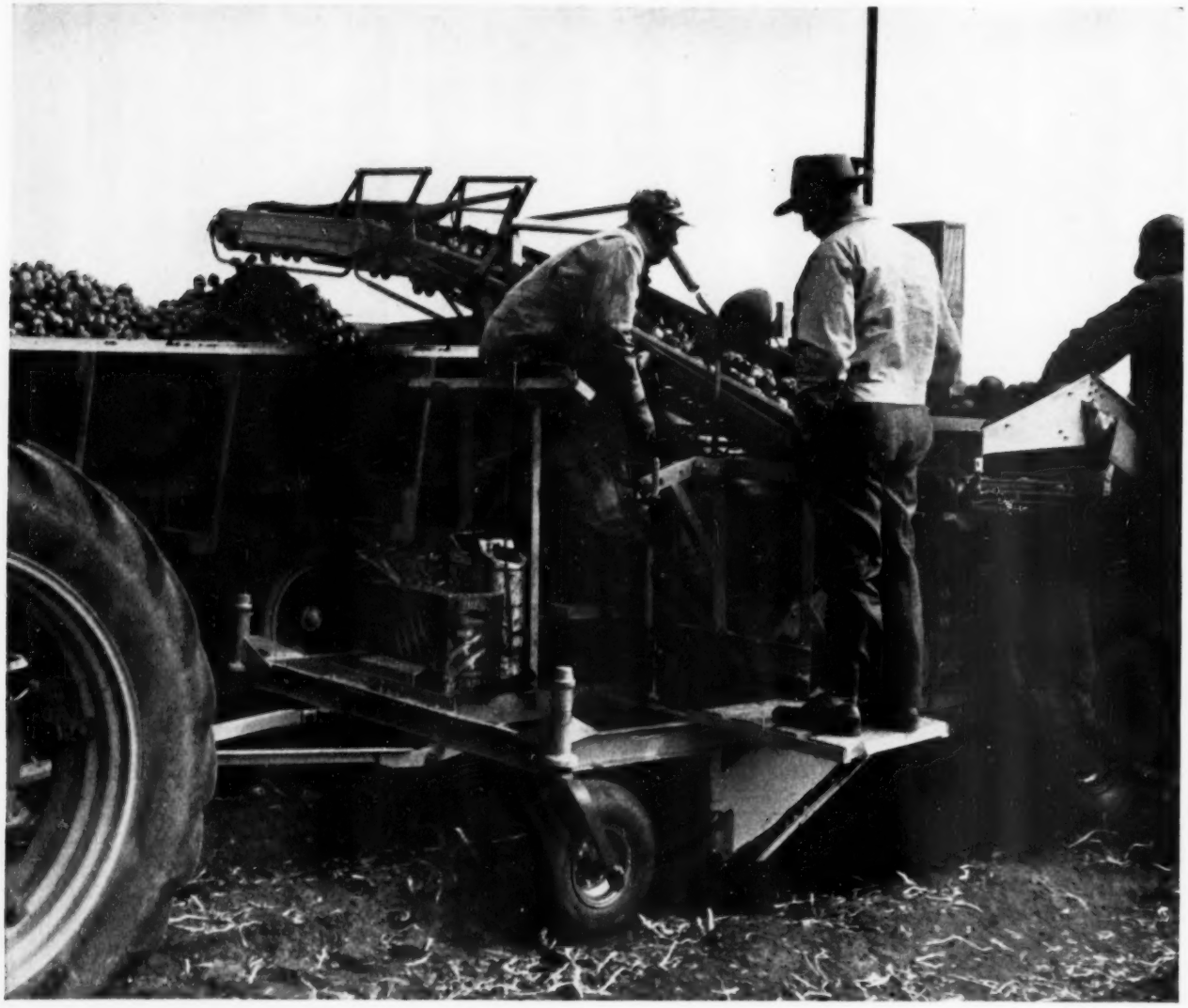
HERE'S THE BIGGEST TAP NEWS IN YEARS . . . and as usual it comes from Morse. These new Special-Purpose Taps . . . set new standards of performance and long life. Get the whole story on this new Morse line *direct and in person* . . . from your experienced Morse-Franchised Distributor, who is always at your service. He has an important new free booklet for you . . . giving complete details on these new Morse Special-Purpose Taps, and full information on the new Unified Threads.

MORSE TWIST DRILL & MACHINE COMPANY
NEW BEDFORD, MASSACHUSETTS

(Division of VAN NORMAN CO.)
Warehouses in New York, Chicago, Detroit, Houston, San Francisco

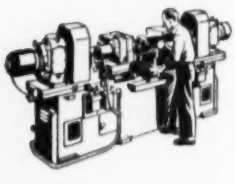
Cutting Tools

LINK-BELT ball



Using various Link-Belt ball bearings—pillow block, cartridge and flanged types—this potato harvester has mechanized another crop . . . Potatoes are dug, separated from vines, dirt and stones and loaded directly into trucks. Built by Champion Corp., Hammond, Ind. Other Link-Belt products specified by the designers: roller chain drives, conveyor screws, flexible couplings.

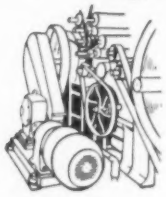
LINK-BELT ball and roller bearings



Metal Working Machinery

Farm Machinery

Construction Equipment



Textile Machines

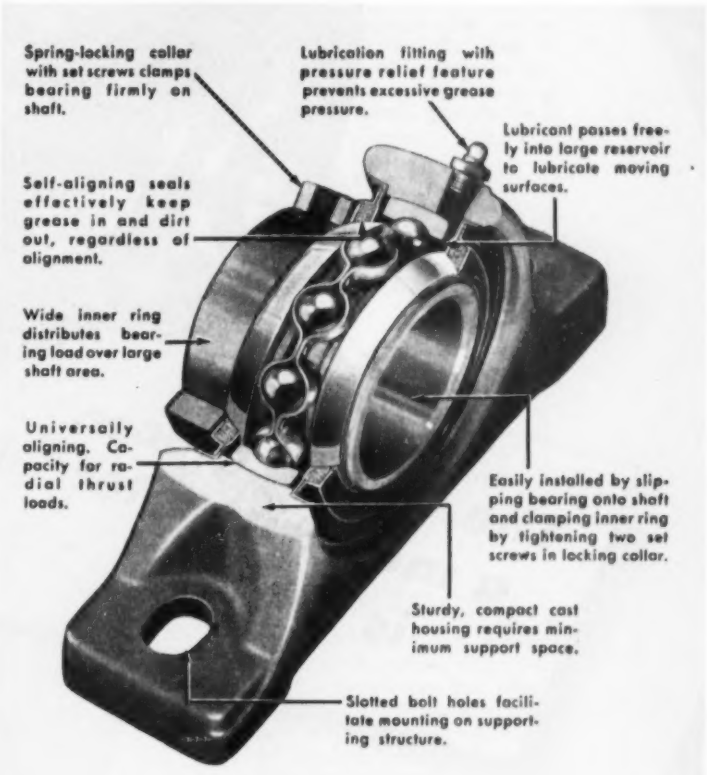
and roller bearings

keep company with America's hardest-working machines

WHERE loads are heaviest and operating conditions most severe—you can always rely on Link-Belt precision ball and roller bearings. That's why so many top equipment designers specify Link-Belt for their tough-job applications.

Thousands of installations have proved the dependability of Link-Belt bearings. Quality construction throughout—combined with precision manufacture—assures the ultimate in accuracy and long life.

There are Link-Belt ball or roller bearings to meet every industrial need. And there's a Link-Belt bearing engineer near you to help apply them to your particular requirements. You can also get all the facts from Data Book 2550.


Spring-locking collar with set screws clamps bearing firmly on shaft.
Lubrication fitting with pressure relief feature prevents excessive grease pressure.
Lubricant passes freely into large reservoir to lubricate moving surfaces.
Self-aligning seals effectively keep grease in and dirt out, regardless of alignment.
Wide inner ring distributes bearing load over large shaft area.
Universally aligning. Capacity for radial thrust loads.
Easily installed by slipping bearing onto shaft and clamping inner ring by tightening two set screws in locking collar.
Sturdy, compact cast housing requires minimum support space.
Slotted bolt holes facilitate mounting on supporting structure.

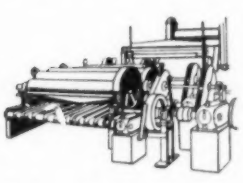
Cutaway of Series 200 Ball Bearing Pillow Block—one of many types in the Link-Belt line of Pillow Blocks, Flanged, Flanged Cartridge, Cartridge, Hanger, Takeup Blocks and Unmounted Bearings.

LINK-BELT

BALL and ROLLER BEARINGS

LINK-BELT COMPANY: Plants: Indianapolis, Chicago, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices, Factory Branch Stores and Distributors in Principal Cities. 53.111

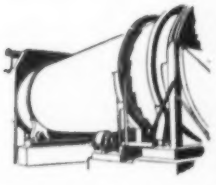
smooth the path of power for all industry



Pulp & Paper Machinery

Materials Handling Equipment

Oil Field Equipment



Processing Equipment

WHAT *Life-Line* REALLY DELIVERS
IS MORE SERVICE . . . LESS SERVICING

Life-Lines are pre-lubricated . . . need no further lubrication. Write for "Facts on Pre-lubricated Bearings" B-4378. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

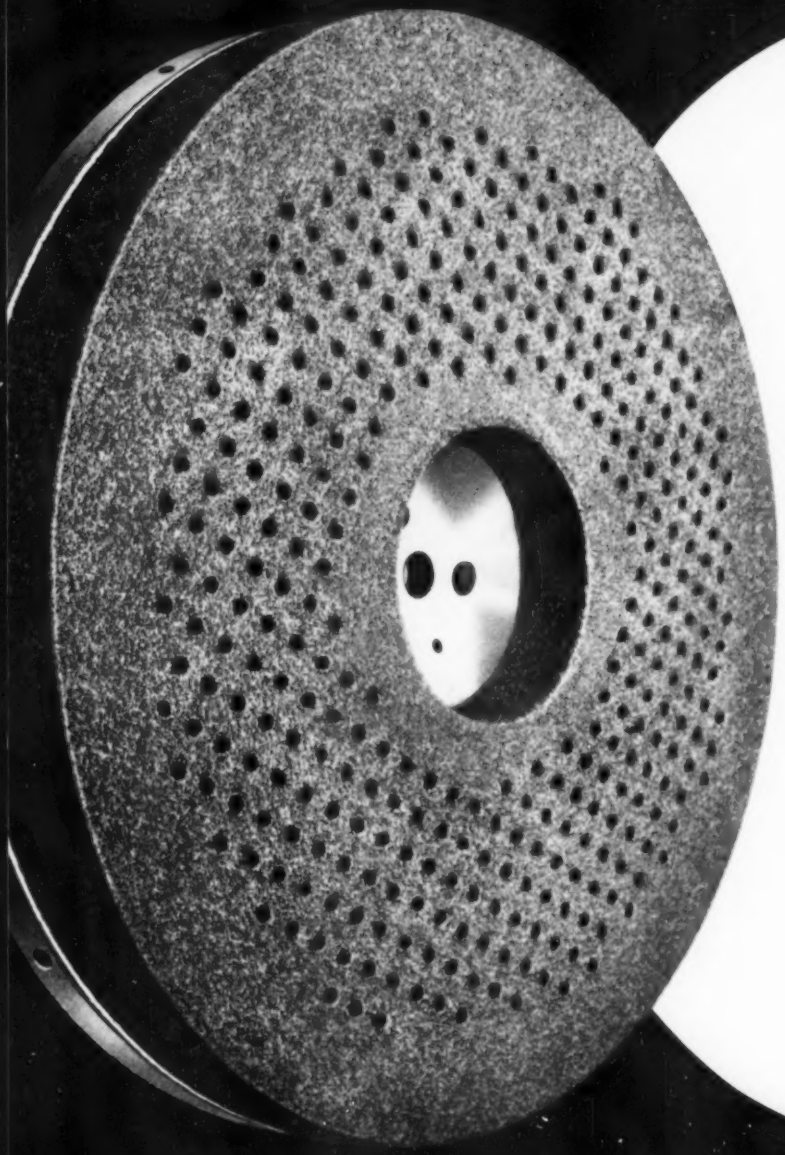
J-21695-A

YOU CAN BE SURE...IF IT'S

Westinghouse

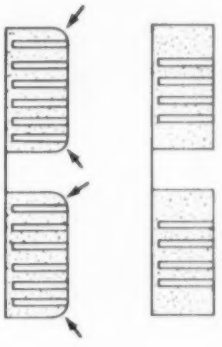
Gardner Abrasive Engineering

How a change in design of disc surface improved accuracy and increased output



THE PROBLEM

Grinding the parallel ends of valve and clutch springs called for high accuracy and fast stock removal. An overall deep corrugated disc gave the desired speed of stock removal. However, the inner and outer edges wore down to cause periodic inaccuracies in work.



THE SOLUTION

Gardner engineers recommended a disc in which the deep corrugations were removed from the surfaces adjacent to the periphery and center hole. Results: A cutting face that did not round off and break down at the edges. Production increased because there were fewer rejects and less time needed for dressing.

Gardner Abrasive Engineering offers experience derived from making both the grinding machines and the abrasive discs. It considers machine performance first and then evaluates how grade and grain of abrasive affect grinding results. If standard abrasive discs won't do the job, discs are made *just for you.*

For help with your grinding problems, consult the Gardner Abrasive Engineer. 106A

GARDNER MACHINE COMPANY
410 Gardner St., Beloit, Wisconsin, U.S.A.

GARDNER

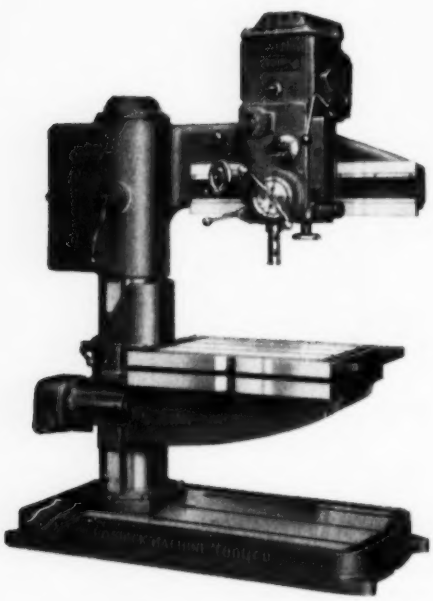
abrasive discs

FOSDICK

precision

positioned holes

production



SENSITIVE RADIAL DRILL

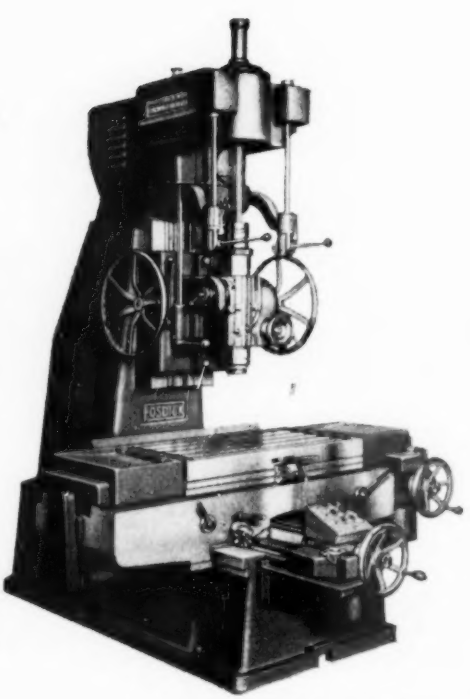
Exclusive with Fosdick, the Sensitive Radial combines upright and sensitive features—rigidity, compactness and convenient table height—with the capacity and flexibility of a radial. Table is universally adjustable, arm rotates at constant height and controls are always within convenient reach. One piece column, 3 and 4 ft. arms. Drills up to 1¼ ".

JIG BORER and AUTOMATIC POSITIONING MACHINE

Jig boring with automatic positioning has eliminated the need for highly-skilled labor for precision hole positioning! With duplicating bars—made quickly, stored easily—the ordinary operator can position table and slide at the same time to within plus or minus .0001" *at the touch of a button!* And Fosdick's Jig Borer costs less than any comparable machine on the market.

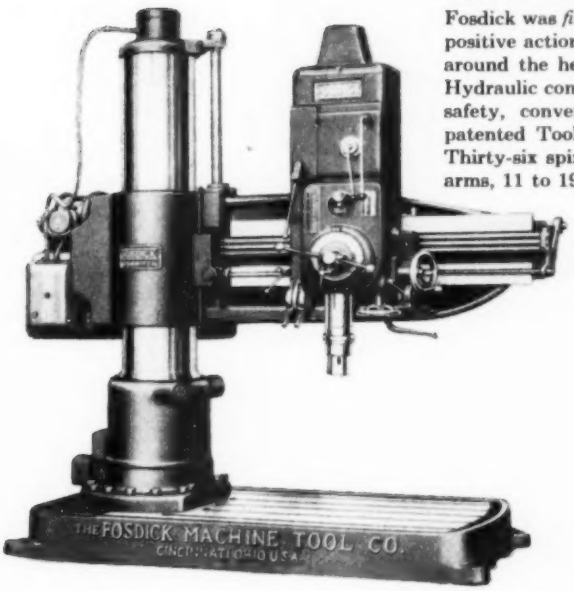
Duplicating drilled, bored and tapped parts—*weeks, months* or *years* apart—is fast, economical with Fosdick's Automatic Positioning machine. Set up time measured in minutes! Costly jigs are replaced by compact duplicating bars made of standard ⅝" stock, bored for each hole.

Table sizes: 18"x36" (no automatic positioning) and 22"x44". Table to spindle capacity, 27". 3 hp motor standard, 5 or 7½ hp optional.



ECONOMAX HYDRAULIC RADIAL DRILL

Fosdick was *first* to use hydraulics in a radial for smooth, positive action, easy operation. Controls are grouped around the head for maximum operator efficiency. Hydraulic controls and clamps are interlocked for safety, convenience. Standard equipment includes patented Tool Ejector and built-in fluorescent tube. Thirty-six spindle speeds, eighteen feeds. 3 to 8 ft. arms, 11 to 19 inch columns.



UPRIGHT DRILL

Two sizes, 25" and 30" with either round or box columns. Twelve spindle speeds from 60 to 1500 rpm, nine power feeds from .005" to .043" per revolution.

SENSITIVE DRILLS

For economical production of small drilled parts. 1 to 6 spindles in either six or nine speeds from as low as 55 rpm to as high as 3600 rpm, four power feeds.

Mail this coupon today!

FOSDICK

The Fosdick Machine Tool Co., Dept. A, Cincinnati 23

Please send descriptive bulletins for the following machines:

- ☐ *Sensitive Radial*
- ☐ *Economax Radial*
- ☐ *Jig Borer*
- ☐ *Automatic Positioning Machine*
- ☐ *Sensitive Drill*
- ☐ *Upright Drill*

Company

Address

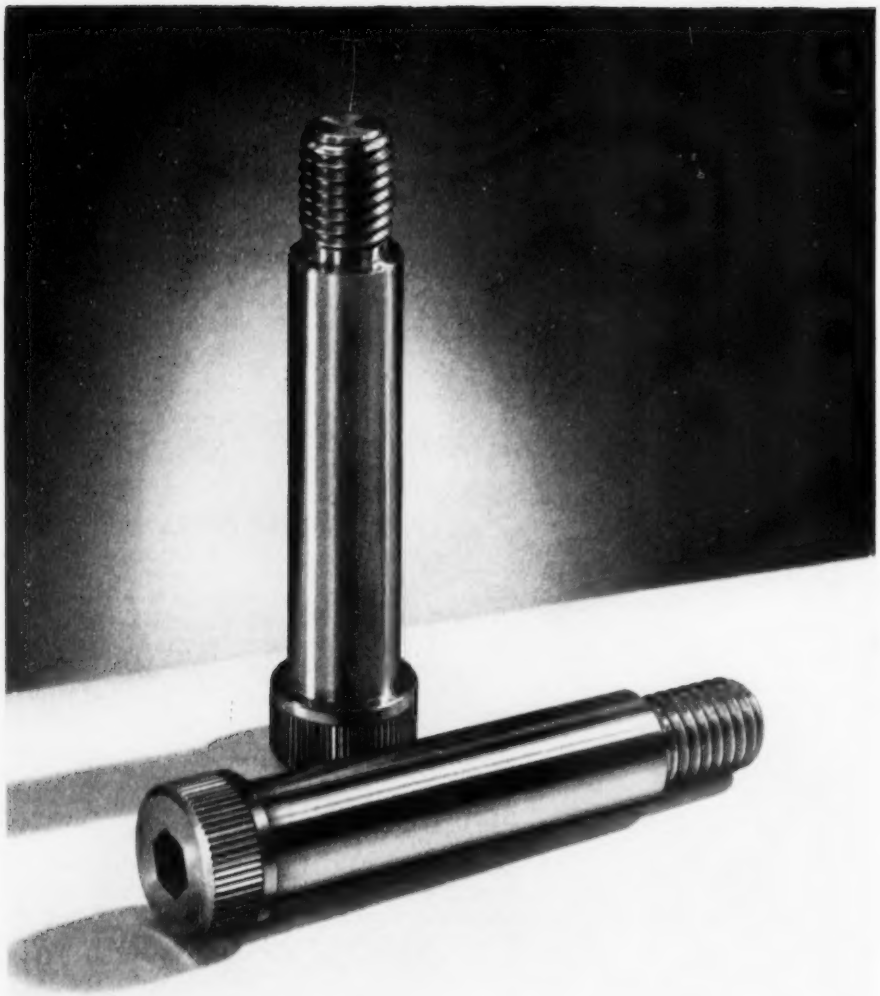
Individual

Title

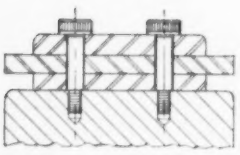
THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

Our Fiftieth Year

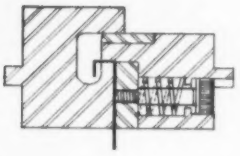
A START FOR THE FUTURE



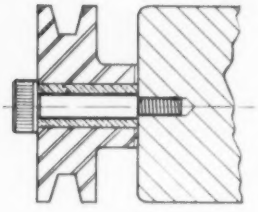
UNBRAKO SHOULDER SCREWS have these features: heat treated alloy steel for strength; knurled head for sure finger grip, fast assembly; accurate hex socket for positive internal wrenching; shoulders held to unusually close tolerances; threads and head concentric with body for uniformly accurate assembly; finished threads close to shoulder; fully formed threads, Class 3 fit; standard sizes, ¼" to ¾" in a full range of lengths.



Use UNBRAKO Shoulder Screws as stationary guides and as moving shafts or pivots.



For pressure pad and stripper plate applications.



As stationary shafts or pivots.

Save time and money, use UNBRAKO standards

Modern methods and quality control produce standardized UNBRAKO socket screw products in large quantities at low cost. A nation-wide industrial distributor organization, which stocks UNBRAKO, assures you excellent service and prompt deliveries. Write for UNBRAKO Standards, a complete listing of standard products stocked by your local UNBRAKO distributor. SPS, Jenkintown 1, Pa.

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SOCKET SCREW DIVISION

SPS

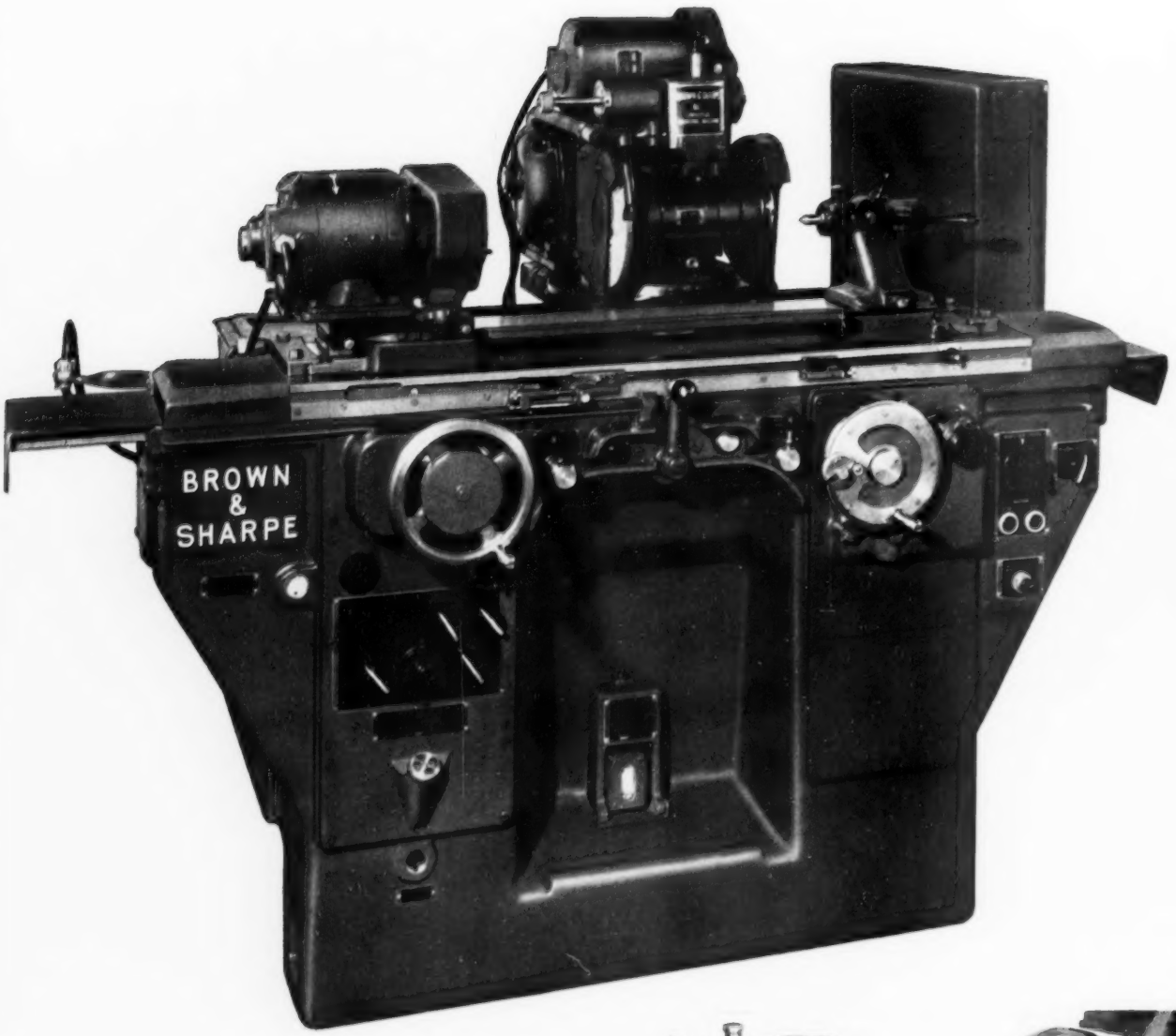
JENKINTOWN PENNSYLVANIA

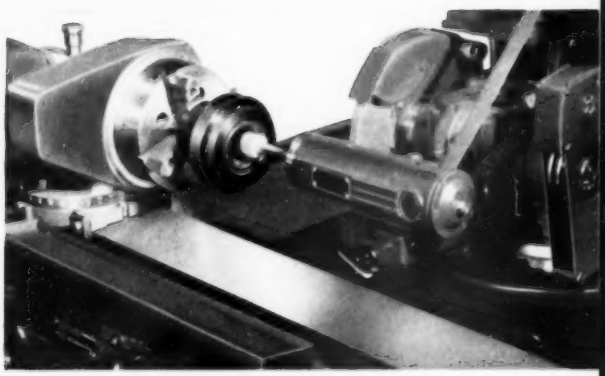
Dramatically New from Every Angle...

The Completely New Line of Universal Grinding Machines

Brown & Sharpe

New in concept
New in versatility, too...



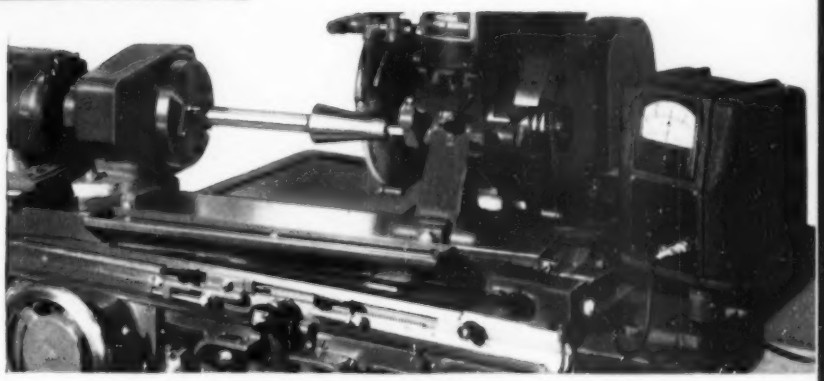


4 Completely New Universal Grinding Machines

In recent years, the broad gap between conventional universal and single-purpose grinding machines has been a serious handicap for many manufacturers. To bridge this gap, Brown & Sharpe now offers a line of completely new Universal Grinding Machines. These machines allow you to instantly combine separate manual operations into automatic cycles for many production applications . . . as well as handle the infinite variety of precision grinding work usually encountered in toolrooms and job shops. Many new and exclusive features provide exceptional grinding flexibility, rigidity, and accuracy. Typical illustrations of their extreme versatility are shown here.

Be sure you know all the advantages of Brown & Sharpe Universal Grinding Machines . . . check the many features on the following page.

Combination Shoulder and Straight Grinding. Note wheel is mounted on right end of spindle and set at convenient angle. Continuous In-Feed Arrangement (optional) assures accurate, smooth finish on shoulder face. When grinding cylindrical portion of work, the wheel can be fed automatically on each or alternate reversals of table. Separate dwell controls for each reversal assure complete "grind-out" at shoulder without delaying reversal at other end of work.



Taper Grinding cylindrical work piece. Extremely accurate taper is established and maintained by the Electralign (optional). Small angular adjustments of the swivel table are indicated directly on the amplifier dial.

Internal Grinding a combination straight and tapered hole using only one set-up. Cross slide is set at the desired angle of taper. Table travel is used to grind straight portion of hole and cross feed is used to grind the taper. Internal spindle nestles into the wheel spindle head when not in use.

Grinding Capacities

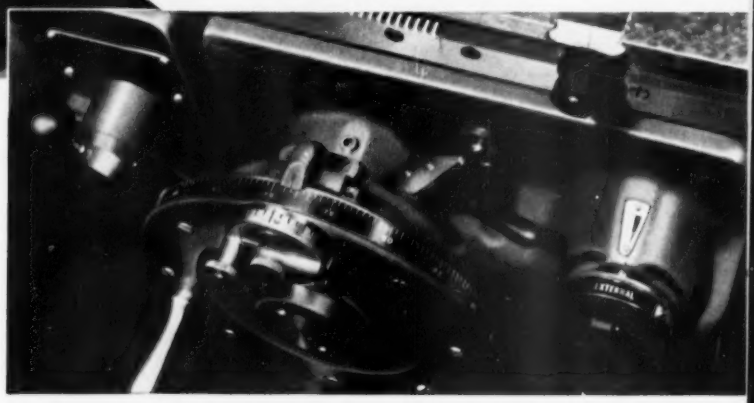
Size	Swing	Centers take Nom.	Max.
1*	10"	20"	22¾"
2	14"	30"	33¾"
3	14"	40"	43¾"
4	14"	60"	63¾"

No. 1 machine illustrated

Brown & Sharpe

Ultra-Modern ...Loaded with New and Exclusive Features!

Completely Universal Wheel Spindle Head with instantly available Internal Grinding Spindle permits either external or internal grinding in any desired horizontal position. Accurately graduated compound swivel permits settings for combination straight and taper, or double taper grinding (both external and internal) with only one set-up.



Cross Feed Handwheel automatically combines manual operations . . . can be set to simultaneously control headstock, table, and coolant action; and advances and retracts wheel. You simply move handwheel counter-clockwise to start and return it to original position to stop.

- Double-end, Removable Unit Type External Grinding Spindle
- Greater Flexibility of Grinding Wheel Speeds
- Variable Speed Headstock
- Variable Speed Hydraulic Table Drive Provides Smooth Table Movement
- Table Throttle with Graduated Dial Permits Exact Repetition of Pre-selected Truing and Grinding Speeds
- Unique Universal Turret Provides Extra Work Capacity
- Fine Cross Feed Adjustable to .0001" on Work Diameter
- Positive Stop on Cross Feed for Both External and Internal Grinding
- Conforms to Basic J.I.C. Electrical and Hydraulic Standards

WRITE FOR INFORMATION ON THESE ADVANCED UNIVERSAL GRINDING MACHINES AND THEIR DIVERSIFIED EQUIPMENT.

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Milling Machines • Grinding Machines • Screw Machines • Cutters • Machine Tool Accessories
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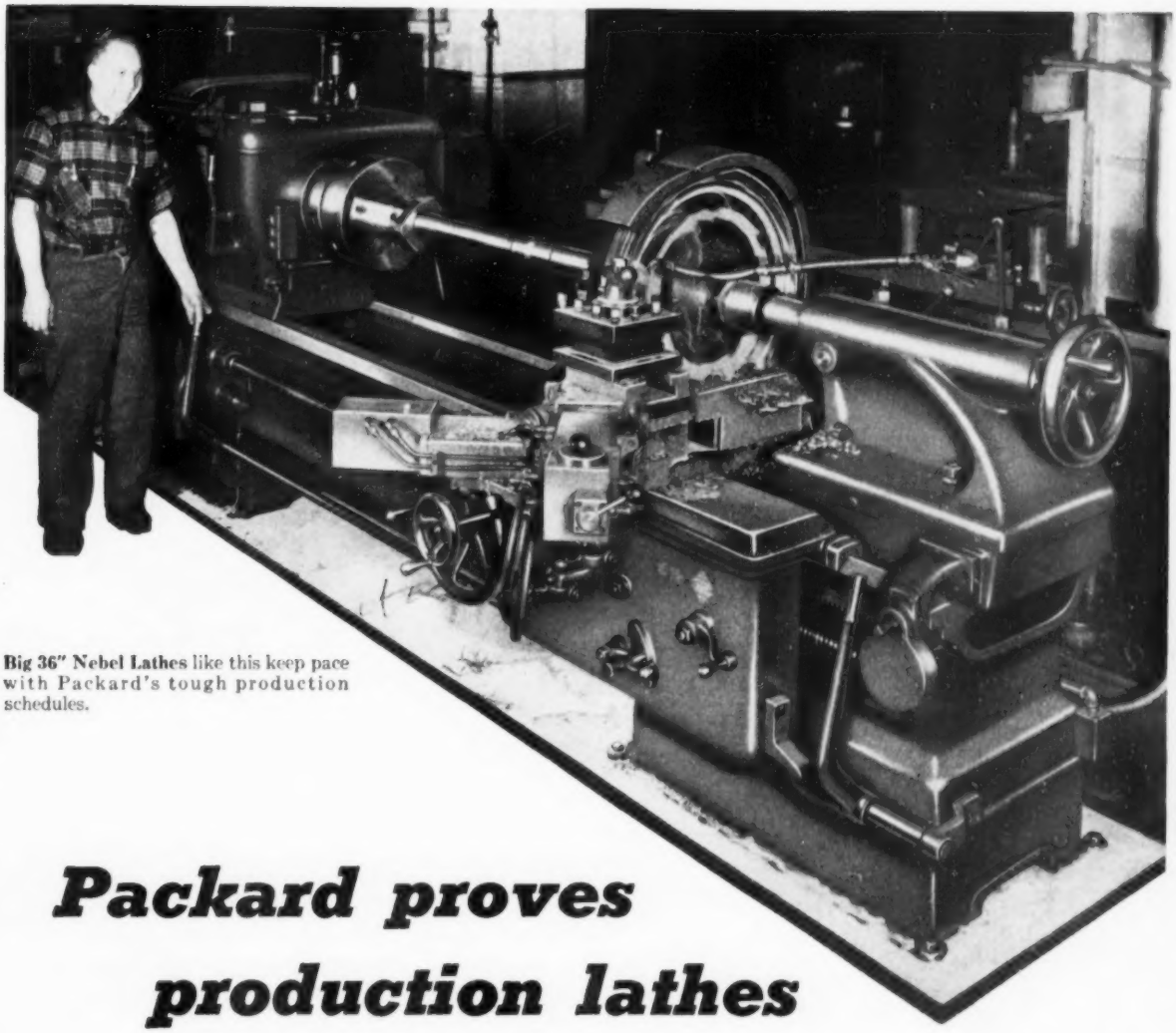


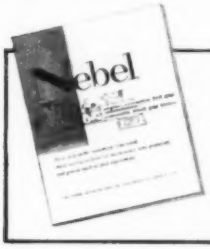
Big 36" Nebel Lathes like this keep pace with Packard's tough production schedules.

Packard proves production lathes needn't be expensive!

Packard Motor Car Co. uses 8 Nebel heavy duty engine lathes—*with precisely the right combination of Nebel attachments* necessary to produce jet engine turbine wheels and shafts.

Nebel lathes are like that: they're basic. They aren't loaded with expensive "extras" you may never need. Yet you can add attachments and accessories *you need* at any time. That's why Nebel lathes—heavy duty engine, removable block gap and extension bed gap—are your very best lathe buy.

Nebel's a natural for maintenance or production. Write for descriptive catalog today. The Nebel Machine Tool Co., Cincinnati 25, Ohio, U.S.A. Members of the National Machine Tool Builders' Assn.

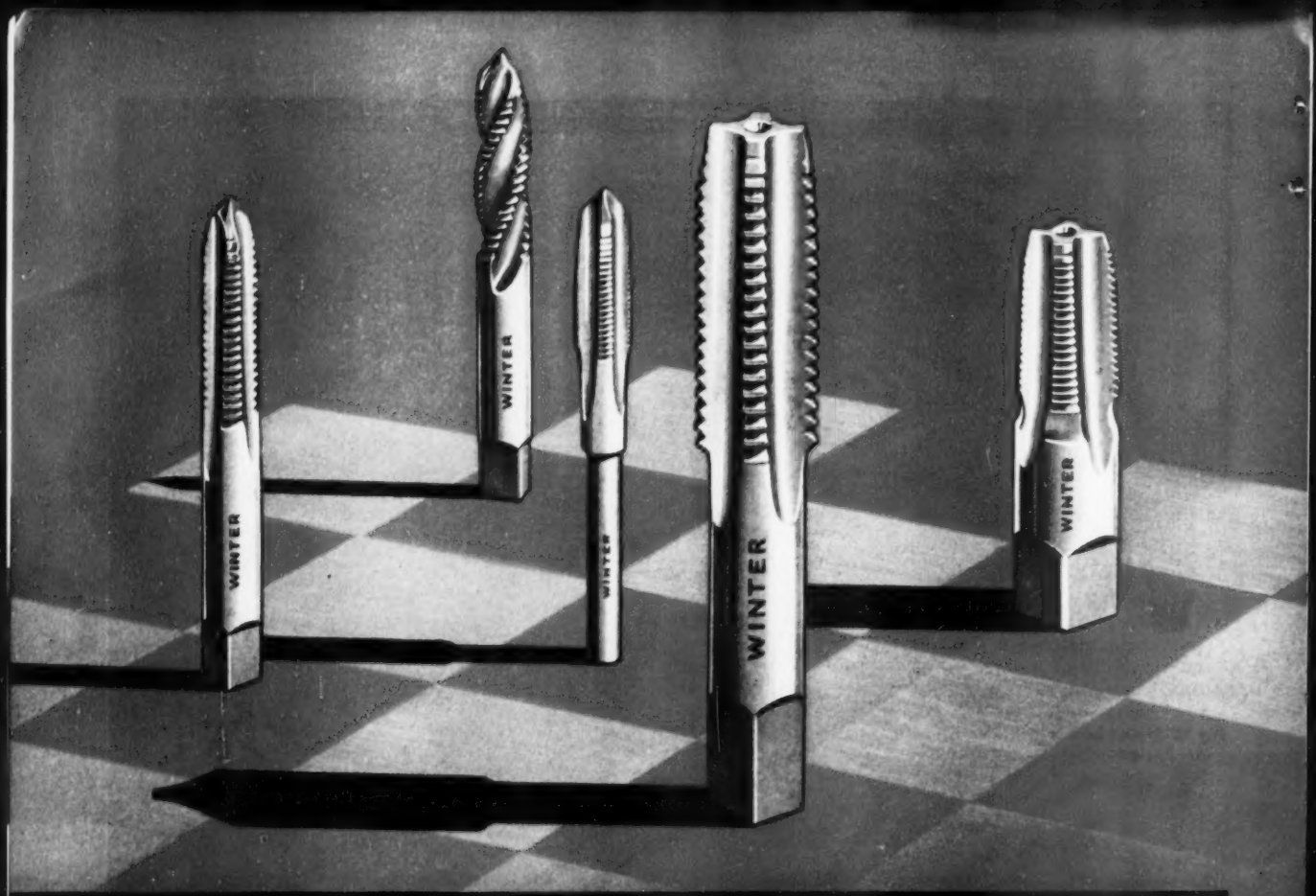


SEE WHY NEBEL'S YOUR BEST LATHE BUY!

Powerful 20-page booklet tells you how a lathe can be so good and yet cost so little. It's yours without obligation. Send for it today.

Nebel

the workhorse of the metal-working shop since 1899

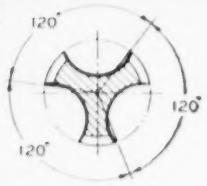


Get These 4 Advantages of

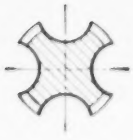
BALANCED Action

BALANCED ACTION results in tapped holes of uniform and accurate sizes; minimum scrap losses; and money saved through longer tool life.

ALWAYS AT YOUR SERVICE
Your local Industrial Supply Distributor carries a complete stock of WINTER Taps.

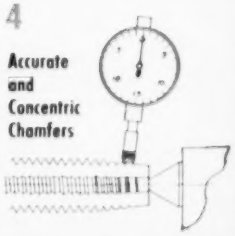
1


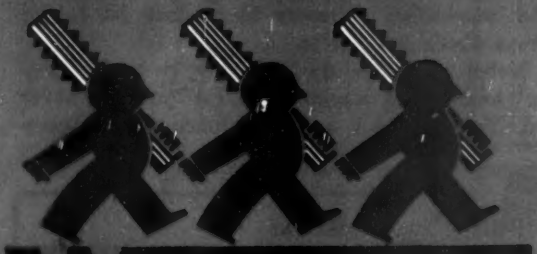
Exact Flute Spacing

2

Uniform Flute Contours

3

Precision Chip Driver Contours

4
Accurate and Concentric Chamfers




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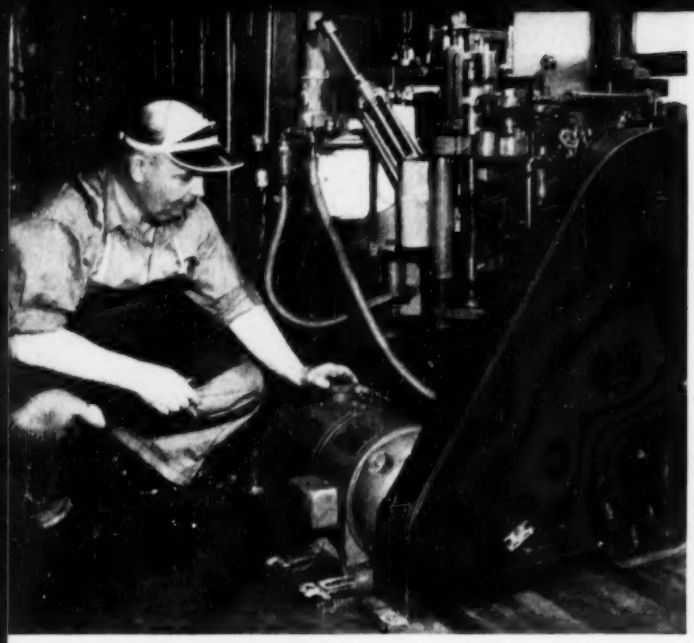
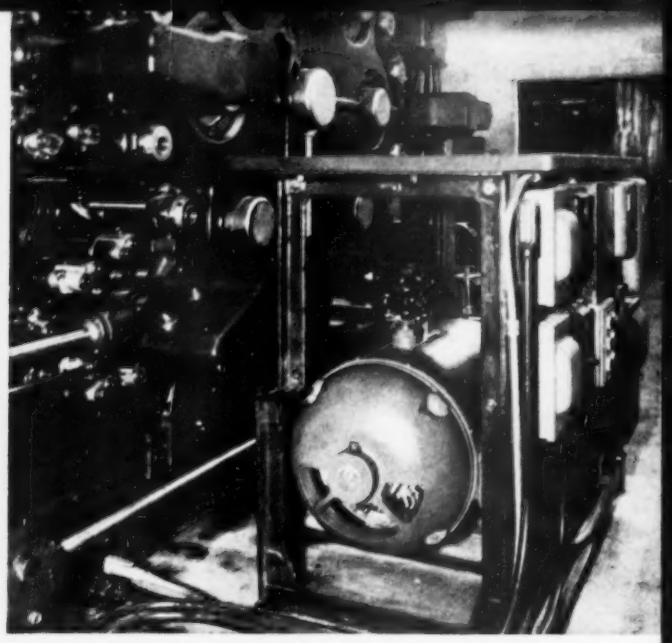
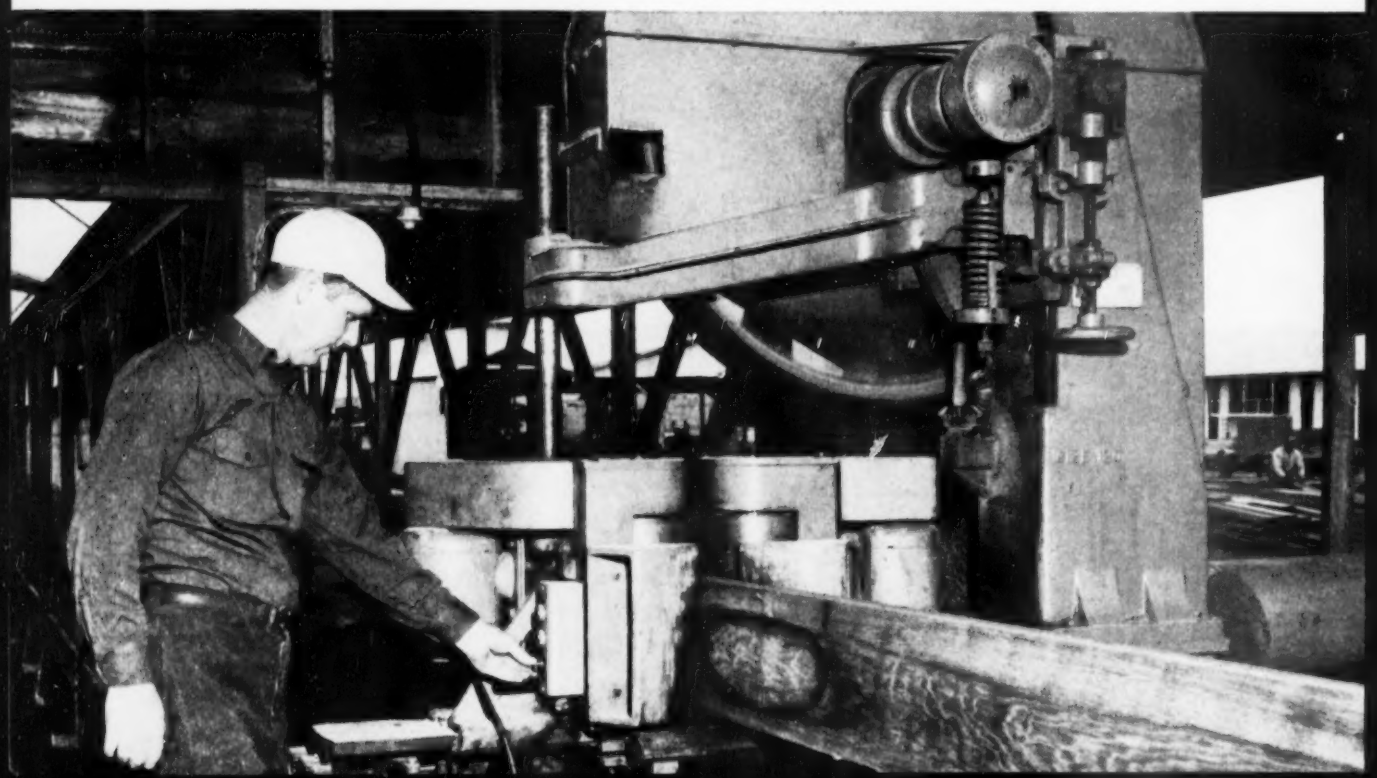


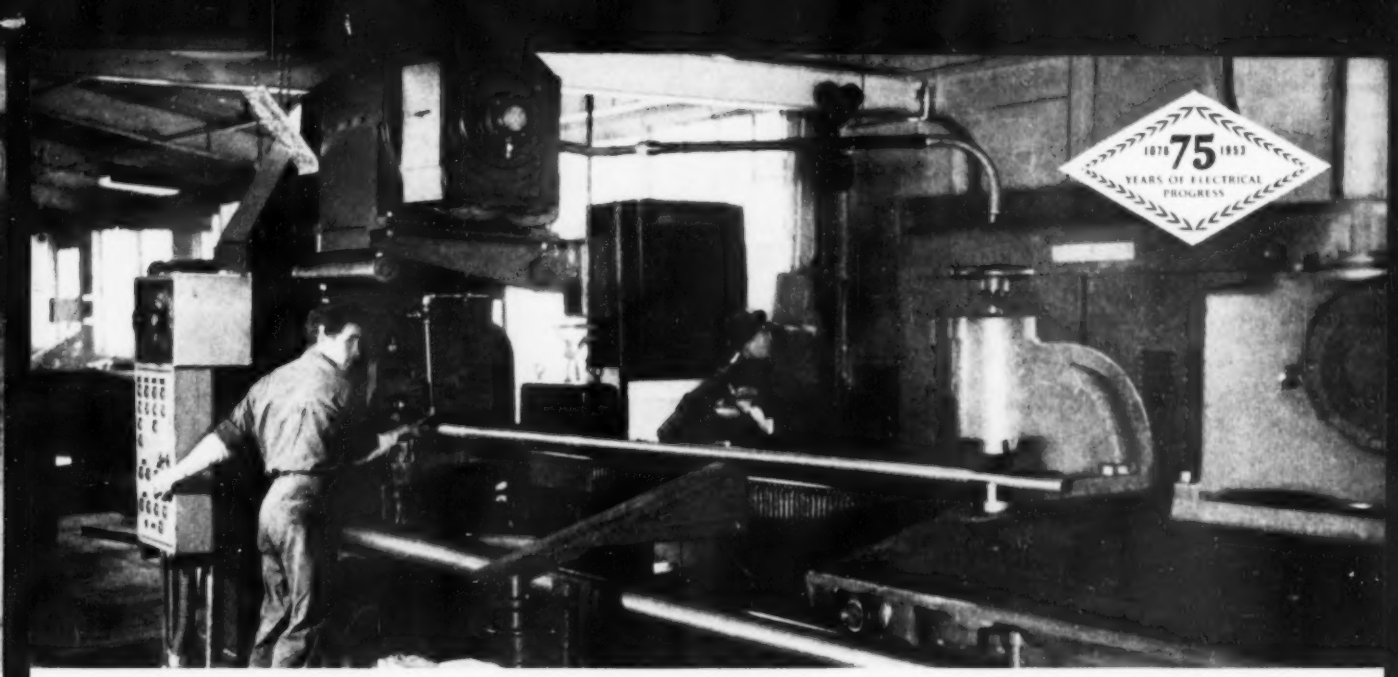


G-E ACA MOTOR as applied on a monotype casting machine in the plant of the Los Angeles Examiner (left) and as the main drive on a five color press in the plant of the Kansas Color Press, Lawrence, Kansas. The G-E ACA motor is your simplest and most economical electrical adjustable-speed drive. You get stepless speed adjustment directly from AC power over a 3 to 1, 6 to 1, and 20 to 1 range. No external conversion equipment is necessary. For additional information, check the coupon for Bulletin GEA-4883.

How a G-E Adjustable-speed Drive

G-E THY-MO-TROL* DRIVE at the San Jose Lumber Sales and Milling Company, San Jose, California, enables the operator to vary the speed of the resaw feed roll from 8 ft. to 250 ft. per minute. G-E Thy-mo-trol Drive can be made to hold speed regulation as close as ± ½%. It is available between 1/40 and 75 horsepower and offers smooth, stepless speed adjustment ranging up to 100 to 1. G-E Thy-mo-trol is easy to install, maintain, and operate. For complete information, check Bulletin GEA-5337 in the coupon at right.





TWO G-E SPEED VARIATORS, one of which drives the cutter-head and the other the bar-feed on this installation at the Allegheny-Ludlum Steel Co., Watervliet, N. Y. G-E Speed Variators are available in ratings from 1 to 200 hp, with excellent speed regulation and in speed ranges up to 40 to 1. With the addition of an amplidyne or electronic regulator, the Speed Variator will give you even closer speed regulation. The packaged power unit is easy to maintain, easy to move to new locations. Ask for Bul. GEA-5335 and 36.

can increase your production!

G-E ADJUSTABLE-SPEED DRIVES mean accurate, stepless motor speed control . . . the chance to improve the versatility of your present machinery . . . increase your production. With a G-E Adjustable-speed Drive you can reduce waste . . . improve product quality.

G-E ADJUSTABLE-SPEED DRIVE WILL ENABLE YOU to produce a greater variety of goods . . . for with the flexibility of adjustable motor speeds you can greatly diversify your product output. Fundamental speed adjustment is available from the G-E ACA motor which is controlled by a simple twist of the dial . . . precise speed control can be obtained with the G-E Thymo-trol drive or Speed Variator. Whatever your need, there is a General Electric Adjustable-speed Drive for you . . . packaged drives are available from 1/40 to 200 hp . . . speed ranges from 3 to 1 up to 100 to 1.

TO GET COMPLETE INFORMATION consult your nearest General Electric Apparatus Sales Office. Your G-E Sales Representative will be glad to recommend the most economical drive best suited for your operation. For printed information on the complete line of G-E Adjustable-speed Drives, use the coupon.

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You can put your confidence in—

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LET G.E. HELP YOU PICK THE RIGHT DRIVE

Because only General Electric makes all major types of electric adjustable-speed drives, it is best qualified to help you select the right drive. Send for these informative bulletins.

☐ **A. This 26-page manual describes all four types of drives and where to apply them. Bulletin GEA-5334.**

☐ **B. Lower cost, simplest a-c drive. Bulletin GEA-4883.**

☐ **C. More flexibility, moderate cost. Bulletin GEA-5335.**

☐ **D. Top performance, 1/40—75 hp. Bulletin GEA-5337.**

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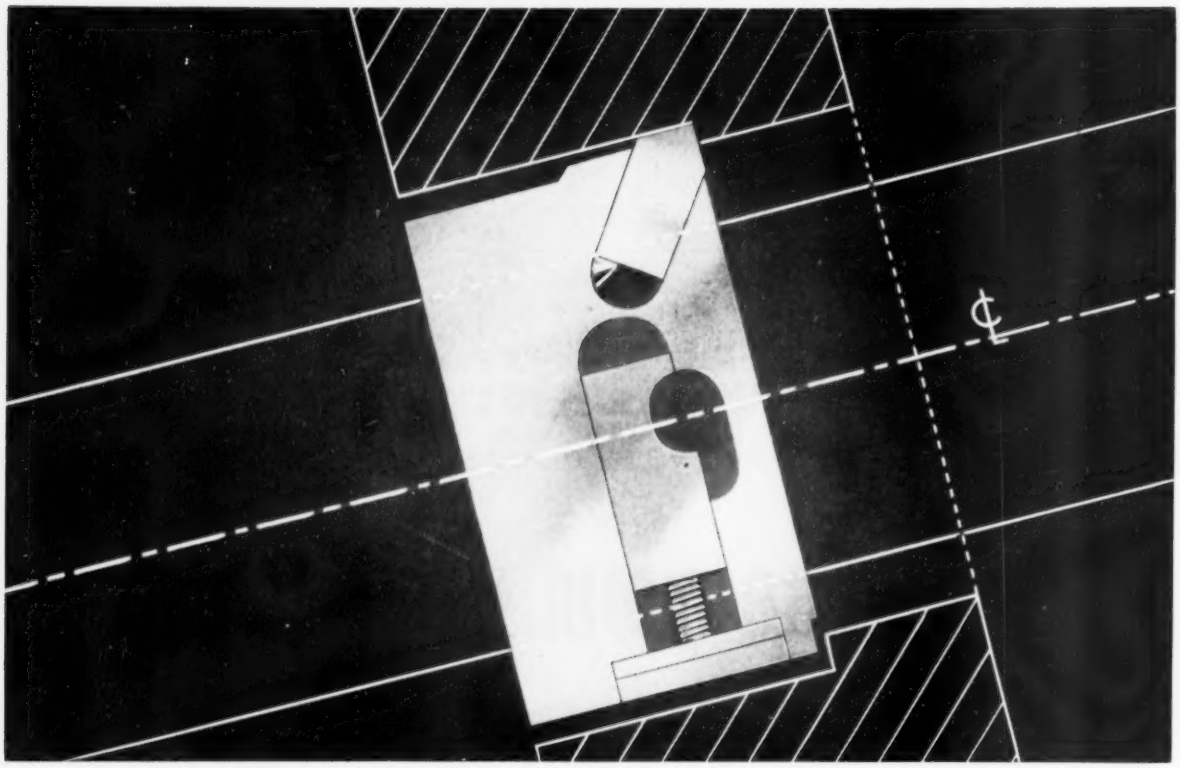
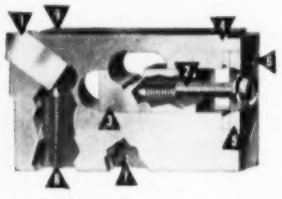
Get fast, positive line boring accuracy for 2½" to 17" dia. with...



DAVIS SINGLE CUTTER MICROMETER ADJUSTABLE BLOCKS



1. Cutter — Carried in stock of HSS or Tungsten Carbide tipped. Other materials per order.
2. Micrometer adjusting screw.
3. Gib — Hardened and precision ground to fit dovetail slot in block, allows for seating and accurately clamping of block with taper lock screw. The taper lock screw clamps the block firmly against the rear of the slot in the same manner as used in the Davis standard block type construction.
4. Keeper Plate — Retains adjusting screw.
5. Keeper Block — Retains adjusting screw.
6. Keeper Screws — Holds assembly in block.
7. Centers — For circle grinding cutter on diameter.
8. Cutter Support Screw — Supports and adjusts cutter for regrinding purposes.
9. Cutter Lock Screw — Locks cutter firmly in place.
10. Cover Plate — (Not Shown). Dovetailed to fit block prevents entrance of foreign matter into gib and screw assembly.

HERE's the way to boost efficiency on general purpose jobs that demand rigidity and a wide range of cutter adjustments.

In addition to regular line boring with either standard or special bars, Davis tools with the exclusive adjustable feature are easily adapted to counterboring, undercutting, grooving, facing or chamfering. Block and cutter adjust as a unit to assure full cutter support at all settings.

Made of high grade tool steel, hardened and ground, the blocks can be furnished with High Speed Steel, Cobalt, Stellite, Tungsten Carbide tipped or Tantalum Carbide tipped cutters.

For details, write for bulletin No. 602.

If Davis can't bore it, it can't be done!

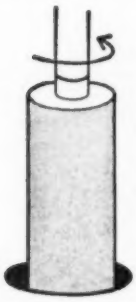
DAVIS BORING TOOL DIVISION

GIDDINGS & LEWIS MACHINE TOOL CO., FOND DU LAC, WISCONSIN

Builders of plain and micrometer adjustable block type boring tools; line boring bars; special boring tools; car wheel boring tools; planer, vertical boring and turning mill tools; Quick Change arbors and sleeves.

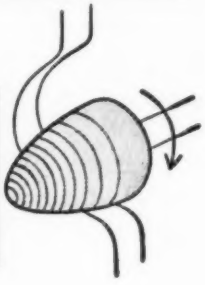
You can save lots of time

with these BEHR-MANNING® Abrasive Tools



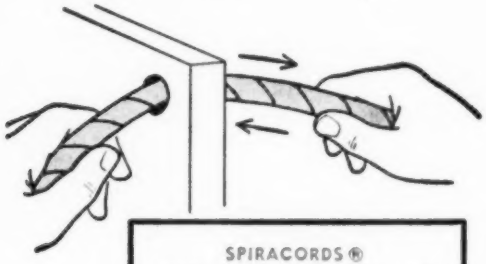
METALITE CLOTH PENCILS

Used on a mandrel for polishing channels, fillets, rounded corners, and the sidewalls and bottom of "dead-end" holes.



METALITE® CLOTH SPIRAPOINTS®

Mounted on threaded mandrels, they produce high finishes in odd-shaped recesses or on various radii.

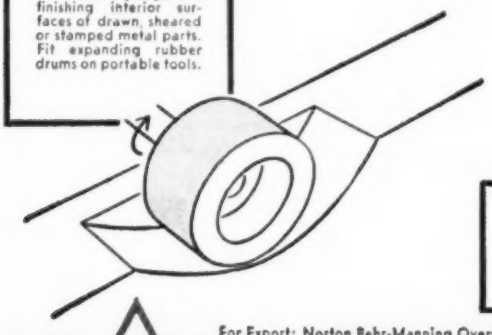


SPIRACORDS®

Narrow strips of METALITE Cloth wound spirally. Can be used on mandrel, or may be threaded like cord through holes for polishing and deburring edges.

SPIRABANDS®

For deburring edges and finishing interior surfaces of drawn, sheared or stamped metal parts. Fit expanding rubber drums on portable tools.

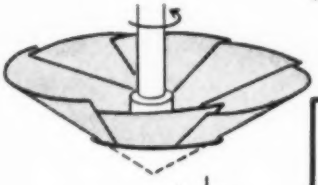


There are dozens of operations in most shops where these handy abrasive tools profitably replace clumsy and time-consuming methods. You can, of course, wrap a piece of abrasive cloth on a round object and polish a hole with it, but why not use a METALITE Cloth Pencil on a mandrel in a portable tool? It's a lot faster. Same for deburring or radiusing the edge of a hole—a METALITE Cloth Slotted Disc is a slick trick for that job.

All of these tools have been devised to cut out profit-leaks on operations that are common in many shops—perhaps in your own. Get in touch with your BEHR-MANNING Field Engineer who will be glad to help you.

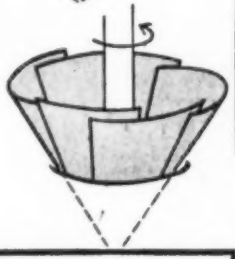
The packet "Blueprints for Production" gives various case histories that show new ways in which BEHR-MANNING coated abrasives are cutting production costs. For your copy, write Behr-Manning Corp., Troy, N. Y., Dept. AM-6.

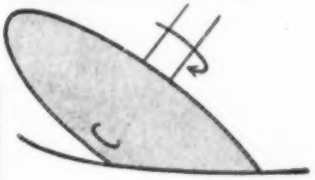
® * Trade-marks



METALITE CLOTH SLOTTED DISCS

When pushed into a hole, the slots enable the sections to overlap, polishing the hole surface. Fine for radiusing and deburring drilled openings.





MUSHROOM* SANDING PADS AND DISCS

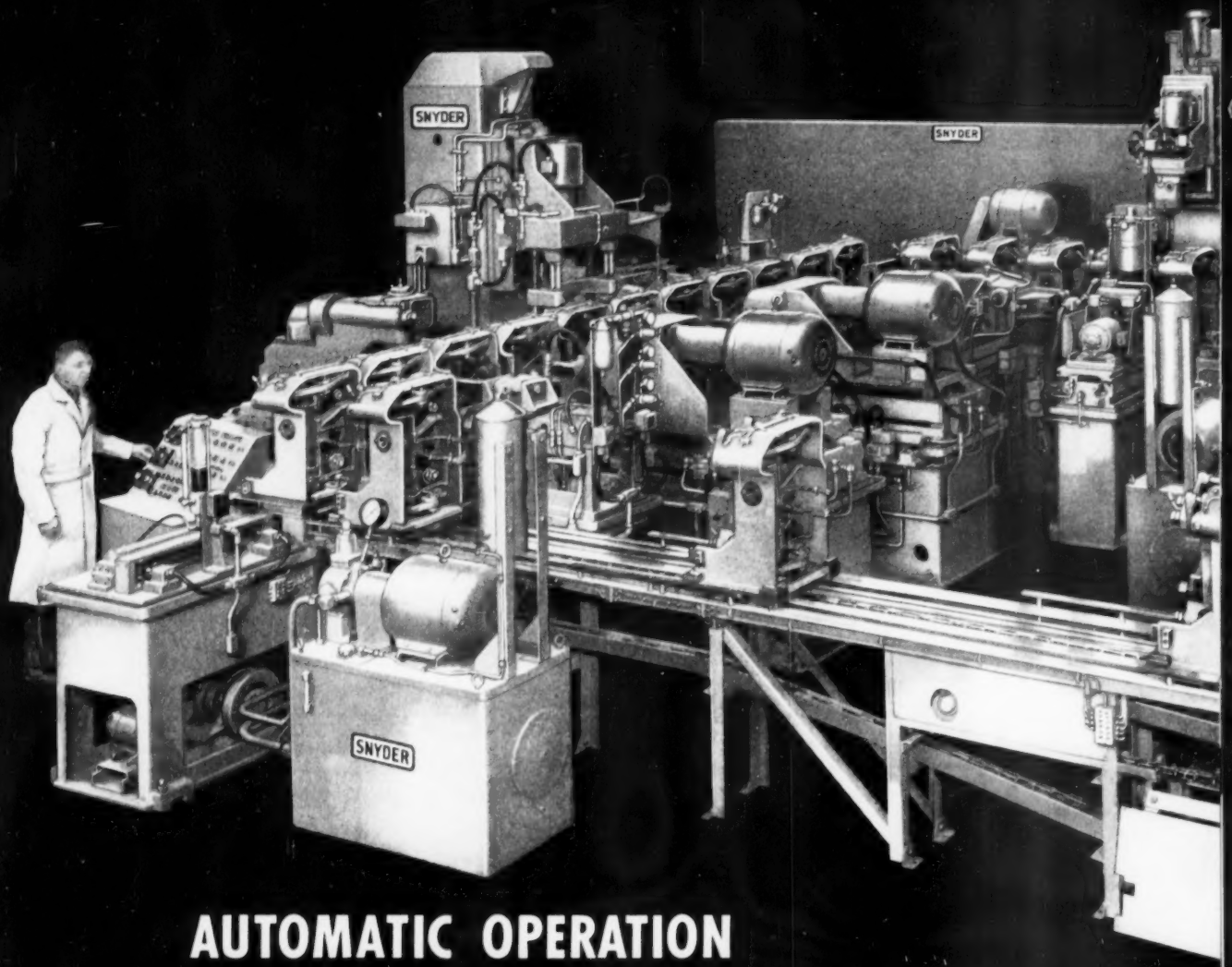
Shape and polish low areas as drawing-die work, deburr and polish edges, finish concave or flat surfaces.

For Export: Norton Behr-Manning Overseas Inc., New Rochelle, N. Y., U. S. A. In Canada: Behr-Manning (Canada) Ltd., Brantford.

BEHR-MANNING® CORPORATION
division of NORTON Company

▲ COATED ABRASIVES
▲ SHARPENING STONES
▲ PRESSURE-SENSITIVE TAPES

SNYDER MACHINES CONTROL COSTS

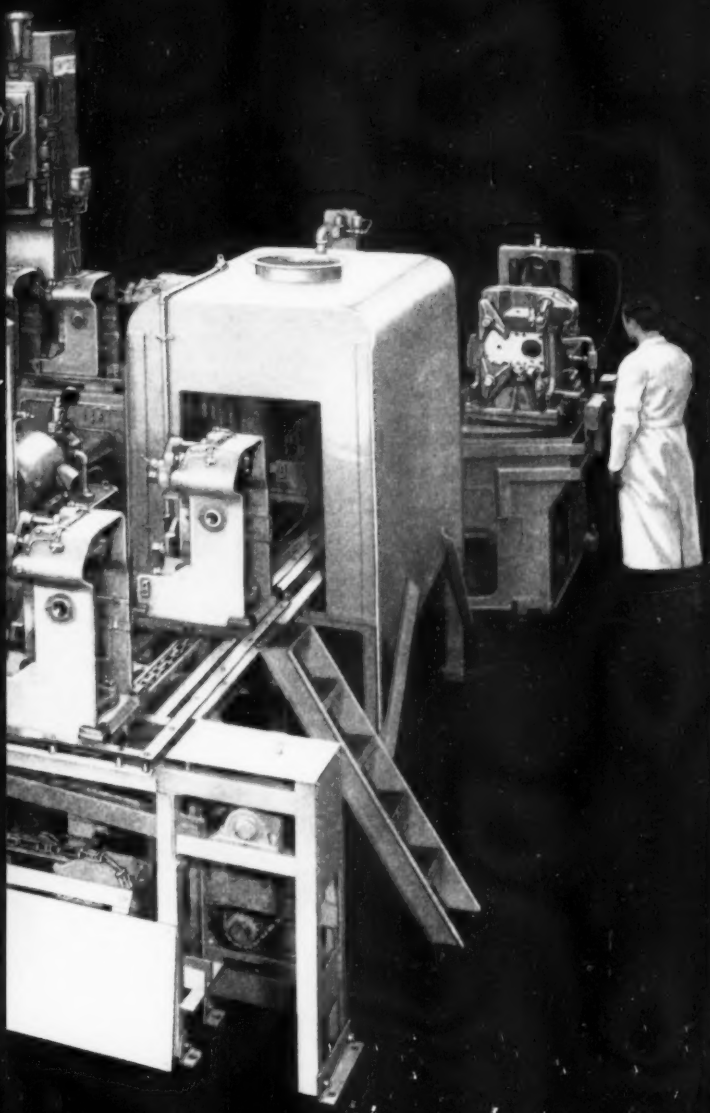


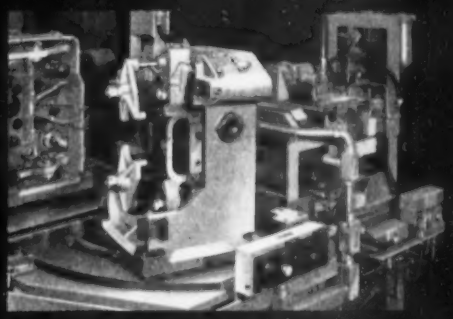
AUTOMATIC OPERATION

MILLS, DRILLS, TAPS, BORES, COUNTERBORES, COUNTERSINKS FRONT COVERS FOR AUTOMOTIVE ENGINES • AUTOMATIC INDEXING, LOCATING, CLAMPING, AND RELEASING • AUTOMATIC TRANSFER THROUGH TWO-STAGE, CONTINUOUS WORK CYCLE • AUTOMATIC CONTROLS • AUTOMATIC SAFETY INTERLOCKING SYSTEM • AUTOMATIC LUBRICATION • AUTOMATIC CLEANING AND CHIP REMOVAL • SKILLED OPERATORS NOT NEEDED

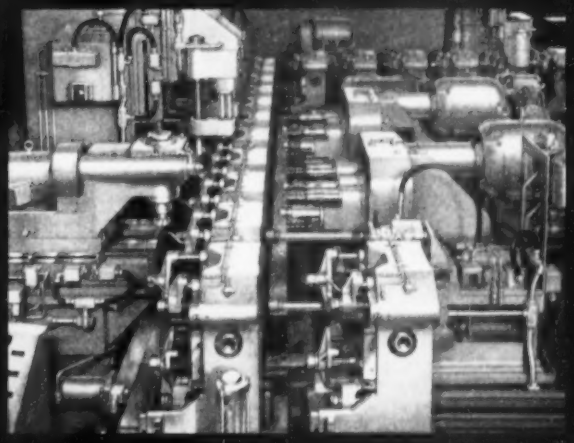
18 STATION AUTOMATIC TRANSFER

180 FRONT COVERS AN HOUR AT 100% EFFICIENCY





At Station 18 the fixture is rotated 90°, air wrenches unclamp the part so that it is easily removed. The fixture returns to Station 18, engages the return conveyor, is automatically blown clean and returned to the loading station.



Fixtures leaving Section 1 (above) move at right angle so that the other faces and top of the part are exposed to tools. The part enters the work cycle with three ground faces, leaves it ready for assembly.

SNYDER

TOOL & ENGINEERING COMPANY

3400
E. LAFAYETTE

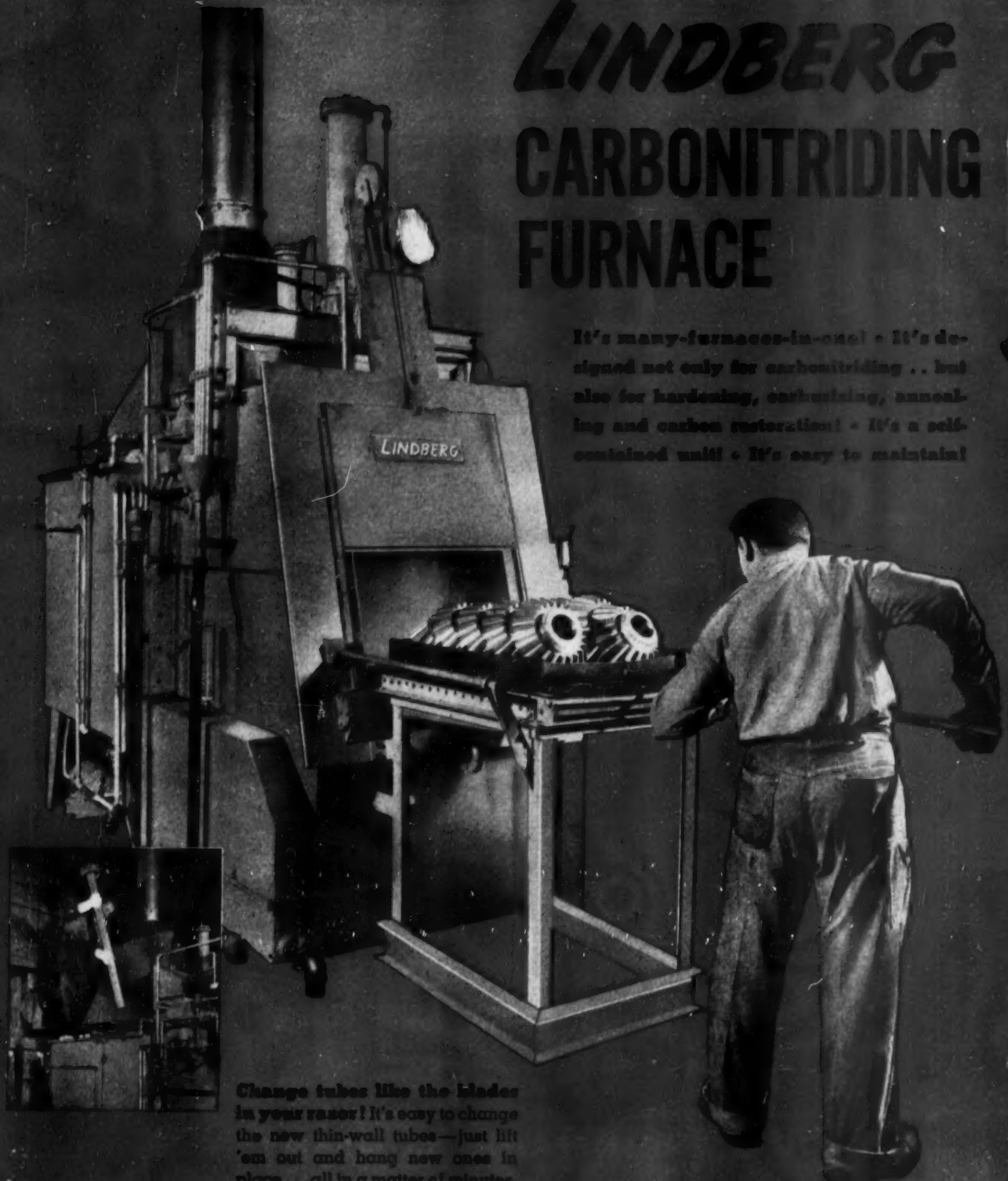
DETROIT 7,
MICHIGAN

28 Years of Successful Cooperation with Leading American Industries

Here's the new...

LINDBERG CARBONITRIDING FURNACE

It's many-furnaces-in-one! • It's designed not only for carbonitriding .. but also for hardening, carburizing, annealing and carbon restoration! • It's a self-contained unit! • It's easy to maintain!



Change tubes like the blades in your razor! It's easy to change the new thin-wall tubes—just lift 'em out and hang new ones in place . . . all in a matter of minutes.

The greatest advance in industrial furnace design and construction since Lindberg introduced the Cyclone forced convection tempering furnace back in 1935!

A 320 lb. load of CRS sleeves. Carbonitrided .010 to .015". 90 minutes in heating chamber. Temperature, 1600° F.

A 400 lb. load of CRS hex nuts. Carbonitrided .001 to .005", 60 minutes in heating chamber. Temperature, 1600° F.

Yes, you must see the new Lindberg Carbonitriding Furnace. It's many furnaces in one . . . it's easy to maintain . . . it's a self-contained unit.

Check these important construction features . . . features that will improve production quality and volume, and reduce production costs.

Many furnaces in one . . . Furnace atmosphere is provided by the Lindberg "Hyen" endothermic atmosphere generator that is easily adjustable to supply different atmospheres not only for carbonitriding, but also for carburizing, carbon restoration, bright hardening or annealing and normalizing. For annealing and normalizing the heated charge cools in the same chamber used for purging.

Easy to maintain . . . Instead of old style, heavy, unwieldly, horizontal radiant tubes . . . new gas-fired, lightweight tubes (only 29 pounds) are used. They're simple to change . . . turn off the gas . . . get on top the furnace . . . lift out the old tube . . . hang a new one in its place . . . and the thin, rolled metal tubes actually last longer!

Quench tank pit unnecessary . . . Your Lindberg Carbonitriding Furnace is self-contained, including a built-in pitless quench tank . . . thus you avoid costly excavation and piping. But more important, this built-in quench tank minimizes distortion . . . quenching takes place within the furnace structure, by means of a vertically operated elevator. Heated charges are never exposed to the air . . . as is the case when work is transferred from the heating chamber to a separate quench tank. Uniform case depth is assured because each charge automatically remains at heat the same length of time.

Purge chamber . . . A specially designed chamber, built immediately above the quench tank and in front of the heating chamber, receives work load for purging prior to heating.

For full details ask for Bulletin 241

A 120 lb. load of CRS screws. Carbonitrided .005 to .008", 45 minutes total time...temperature, 1580° F.

Lindberg Engineering Company — 2448 W. Hubbard Street, Chicago, Illinois

LINDBERG FURNACES

DIALIZE and ECONOMIZE

Any AGD Adjustable Limit Snap Gage becomes a DIAL INDICATOR Snap Gage with a STANDARD *Dializer*

Patented

Simplicity Itself!...

By removing a pair of pins from the snap gage and inserting a STANDARD Dializer any make of AGD Snap Gage in any model, A, B or C, is instantly converted to a DIAL Snap Gage. Dializer is easily transferred from one frame to another.

Dializers are available for complete range of AGD Adjustable Limit Snap Gages (MODELS A, B or C)

No. 1 fits AGD Frames 1 thru 6
No. 2 fits AGD Frames 7 thru 10
No. 3 fits AGD Frames 11 thru 16

No. 3 Dializers also fit larger size frames beyond AGD size range (available from STANDARD) for dimensions up through 26⅝".

ACCURACY ASSURED by double reed principle.

RANGE OF ADJUSTMENT of gage is unaffected.

INDICATOR either with .0001" graduations and .005" range, or with .001" graduations and .025" range.

We can supply snap gage frames if you do not already have them. Tungsten carbide contact points, anvil blocks and snap gage pins are also available.

Write Today for Your Copy of Catalog C

Dialize Your LENGTH GAGES, too!

Dializers can also be used on any AGD Adjustable Limit Length Gage, Progressive Type for internal or external measurements.

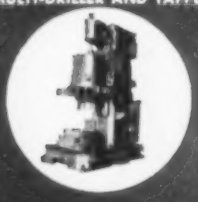
STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.

Your "Hole" Future

IS ASSURED WITH NATCO EQUIPMENT

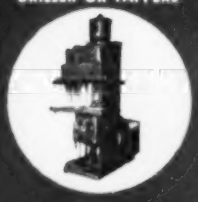
ENGINEERED FOR QUALITY AND QUANTITY PRODUCTION

ADJUSTABLE SPINDLE MULTI-DRILLER AND TAPPER



MEDIUM SIZED VERTICAL DRILLER AND TAPPER

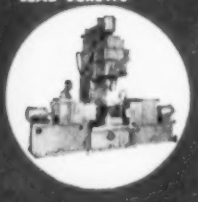
HIGH-SPEED MULTI-DRILLER OR TAPPERS



A-33 LIGHT SENSITIVE MULTI-DRILLER OR TAPPERS

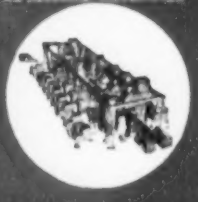
2-WAY BOREFACE FOR BORING, TURNING AND FACING

3-WAY HOLETAPPER WITH INDIVIDUAL LEAD SCREWS

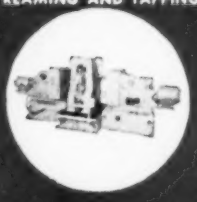


HOLESTEEL 2-WAY FLOOR TYPE FOR DRILLING AND TAPPING

HOLEWAY AUTOMATIC PROCESSING MACHINES



2-WAY HOLEUNIT FOR DRILLING, BORING, REAMING AND TAPPING



STATION TYPE MACHINES

Here are a few representative machines from the complete NATCO line . . . including a wide range from small, fast, light sensitive multi-drillers and tappers to large automatic processing machines . . . from single spindle to an unlimited number of spindles . . . from 1/16 inch drill to 14 inch or larger bore. Materials worked include iron, steel, bronze, aluminum, plastic and wood. Call a NATCO Field Engineer.

Call a Natco Field Engineer

To help you solve your problems in Drilling, Tapping, Boring & Facing.

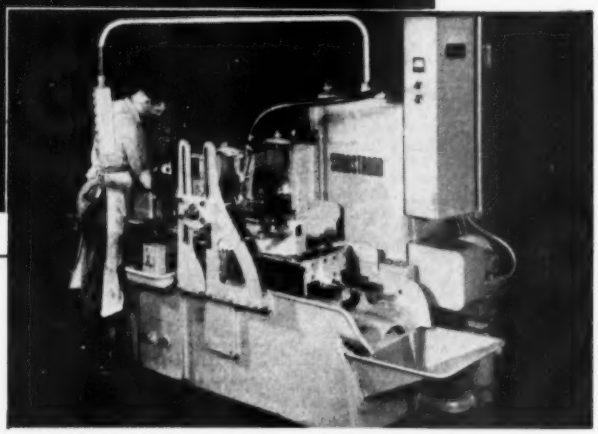
NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Indiana

Branch Offices

1809 Engineering Bldg., CHICAGO • 409 New Center Bldg., DETROIT
1807 Elmwood Ave., BUFFALO • 2902 Commerce Bldg., NEW YORK CITY

How To Use SUNDSTRAND "Engineered Production" Service To Get Practical Milling Methods



Basically, there are two approaches to solving milling production problems, (1) obtaining standard machines, then trying to process parts over these machines as economically as possible, (2) designing the most profitable processing method, then obtaining machines to suit this method — standard or semi-standard machines, if possible, or entirely special machinery, if necessary.

The latter method is Sundstrand "Engineered Production" Service . . . the most practical approach to economical milling. The following is a brief resume of the complete engineering and manufacturing service available from Sundstrand to meet any of your production milling requirements.

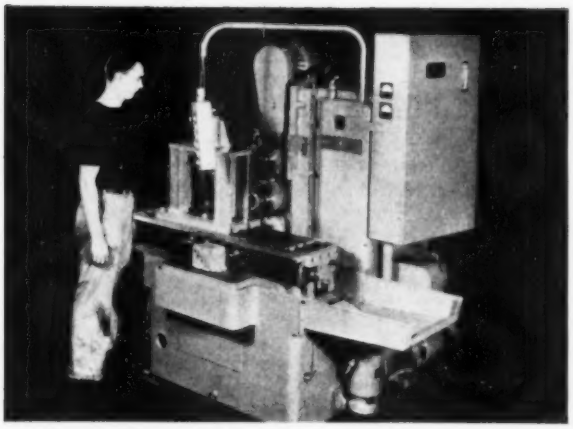
These actual examples are presented to reveal one of each of the methods used in solving milling production problems. One of these methods may be the solution to your present problem.

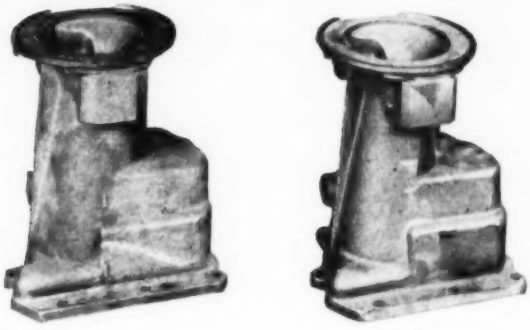
1 Milling Steel Forgings With a Standard Rigidmil

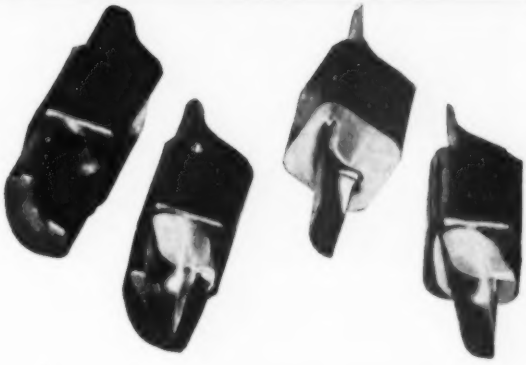
This Standard Sundstrand Model 33 Rigidmil is equipped with a special manually operated left and right hand fixture. Operator loads the rough forgings into the left hand fixture where a 1.875″ slot and one face is milled. The workpiece is then removed from the left hand fixture and loaded into the right hand fixture for milling a 1.640″ groove. Production for both operations totals 32 pieces per hour.

SUNDSTRAND

RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT







2 Standard Rigidmil With Special Head Mills 2 Surfaces Simultaneously

Here's a good example of a standard machine tooled to do special production milling. This standard Sundstrand Model 22 Rigidmil has been provided with a special two-spindle head with independent drive to each spindle. The machine simultaneously mills the bottom face and the flange on a transmission bearing retainer held in simple fixture. In an automatic cycle of rapid approach, feed and rapid return, 60 pieces are milled each hour.

3 Special Rigidmil Mills Contours and Root Radius of Turbine Bucket Blades

Here is a Sundstrand Special 3 Station Contour Milling Machine. Three separate milling units are mounted on one main base for milling the contour of turbine blades. Unit No. 1 mills the inside contour of the part. Unit No. 2 mills the outside contour and unit No. 3 mills the root radius. Machine cycle is automatic and operator has only to transfer the piece from one station to the next. Production is 25 blades per hour.

Free Data

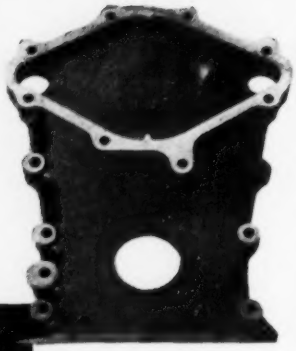
Write for more proof of successful applications of Sundstrand "Engineered Production" Service. This 40 page book contains over 35 actual problem solutions together with interesting tooling diagrams. Write for your copy today. Ask for Bulletin No. 132.

SUNDSTRAND

SUNDSTRAND
Machine Tool Company
2533 Eleventh St. Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES

what's your time estimate on this job?



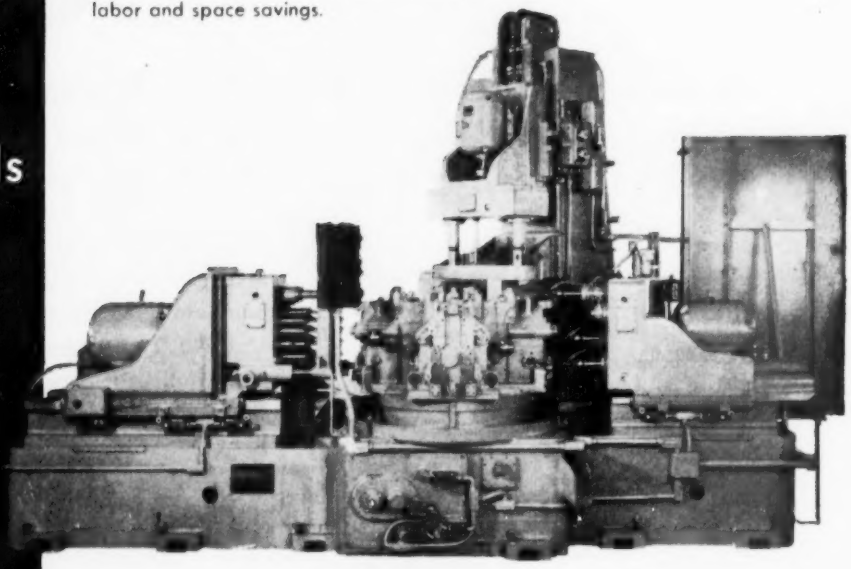
DRILL	19	HOLES
ROUGH BORE	2	HOLES
FINISH BORE	1	HOLE
CHAMFER	7	HOLES
REAM	1	HOLE
TAP	6	HOLES

Morris MOR-SPEED

Finishes One Part Every 33 Seconds

Machining a front cylinder cover for a popular make automobile engine, this four-way MORRIS Machine performs a two-cycle operation, and is production rated at 110 parts per hour at 100% efficiency. A total of 34 spindles do the operations listed above.

If your work requires numerous drilling, reaming, tapping and boring operations on a mass production basis, consult MORRIS Engineers. They will gladly show you case history proof of time, money, labor and space savings.



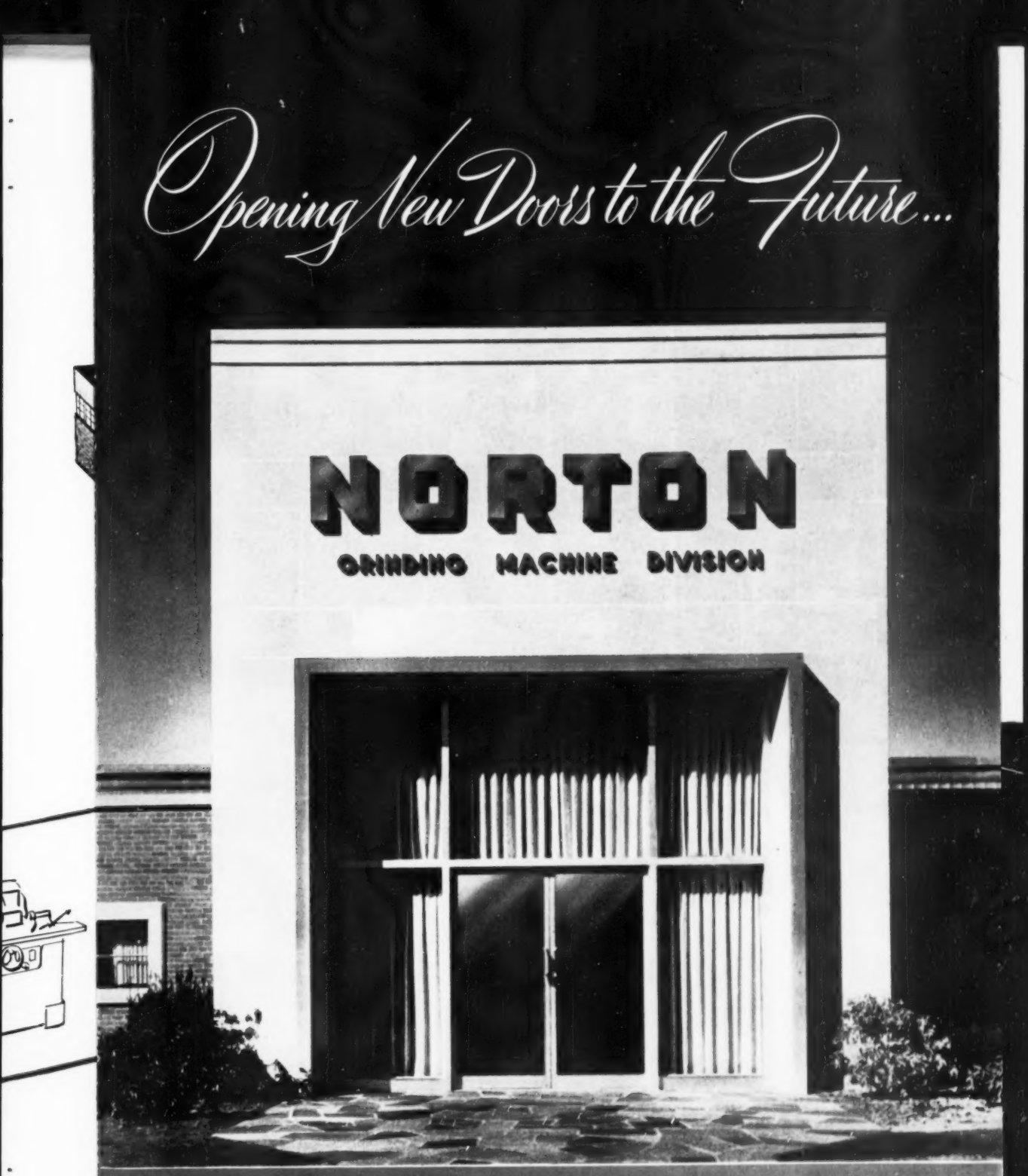
"A Better Product at Less Cost with PRECISION PLUS PRODUCTION."

Builders of MOR-SPEED Line

Morris

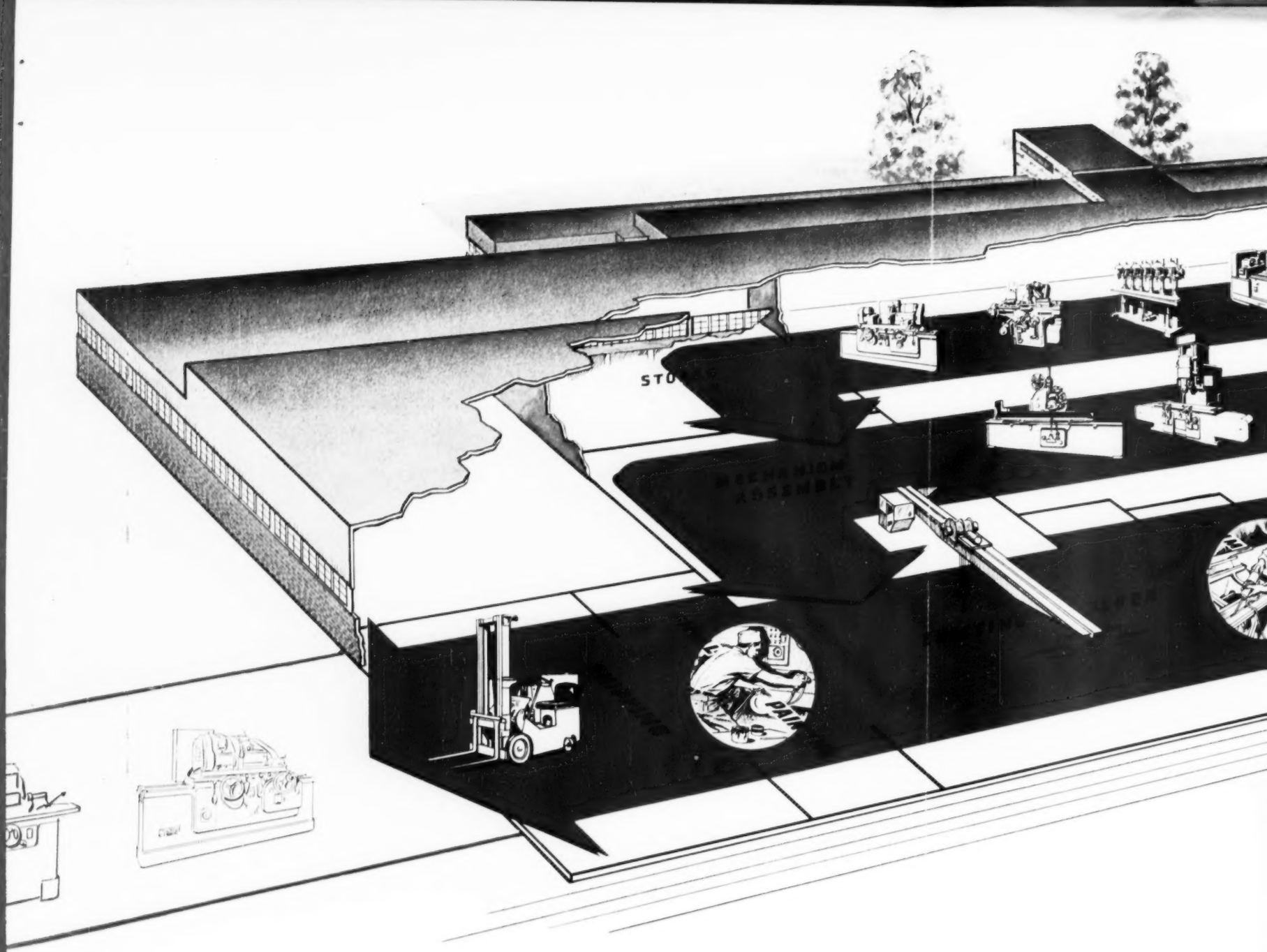
THE MORRIS MACHINE TOOL COMPANY
933 HARRIET STREET CINCINNATI 3, OHIO

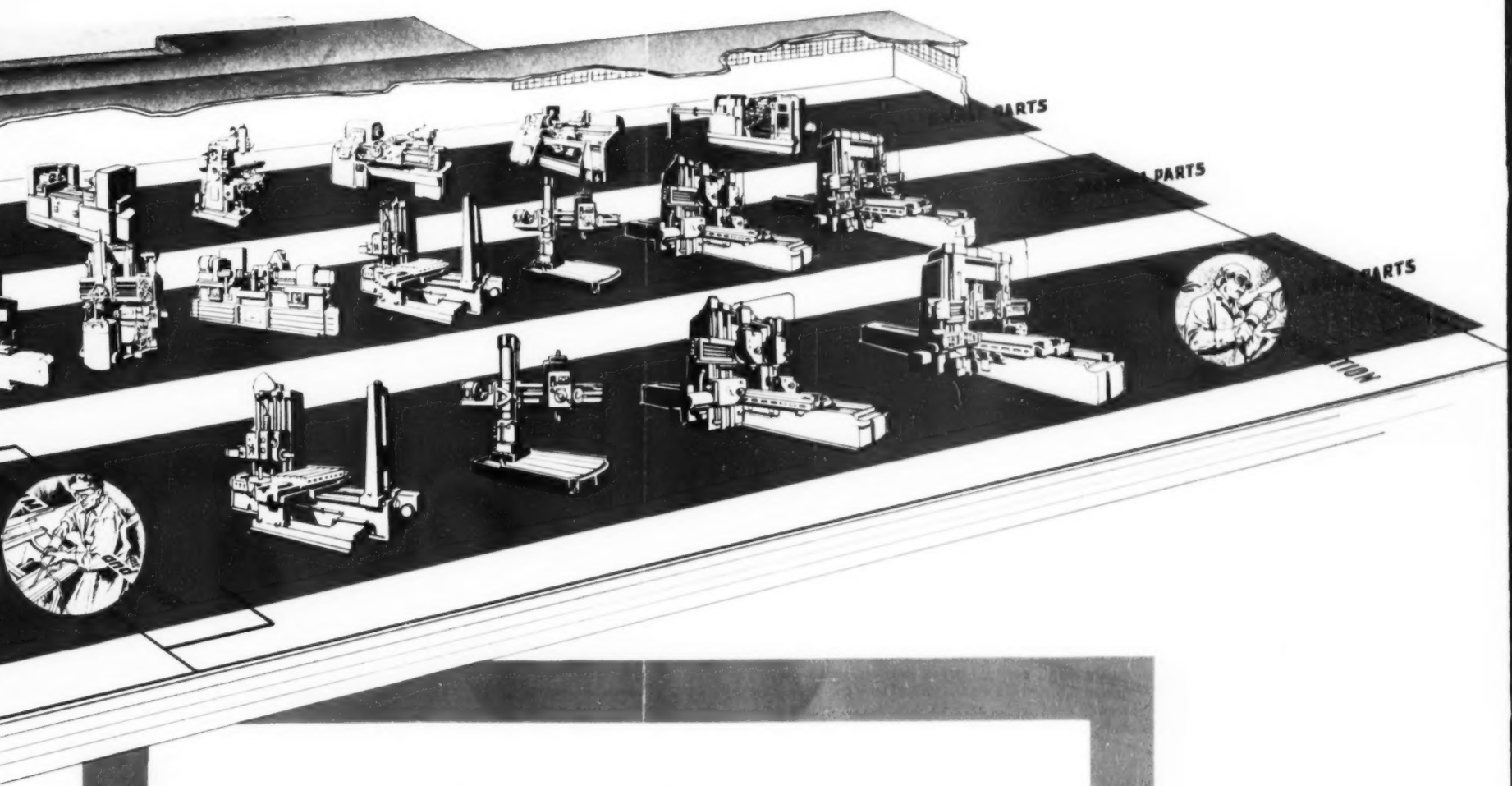
Opening New Doors to the Future...



to Give Industry the

"TOUCH OF GOLD"





Flow Chart of the
New Norton Grinding Machine Plant

AT WORCESTER, MASS.

Open as a baseball diamond although many times larger. Production flows in-line, unusual in the construction of machine tools. Five major production lines are in operation, two for heavy castings and three for medium to small parts. Departmentalization has been eliminated in favor of continuous processing. Back-tracking and trucking are at the irreducible minimum. In this big ultra-modern fabricating plant, Norton Grinding and Lapping Machines are being built better than ever.

NORTON COMPANY

MAIN OFFICES AND WORKS • WORCESTER, MASS.

NORTON

ABRASIVES AND GRINDING WHEELS • GRINDING AND LAPPING MACHINES • REFRACTORIES AND LABORATORY WARE
BORON CARBIDE GRAIN AND MOLDED PRODUCTS • PULPSTONES • NON-SLIP FLOORS • LABELING MACHINES

WORCESTER 6, MASSACHUSETTS

June 1, 1953

To Our Customers
and Other Friends:

We are now operating our new Grinding Machine plant at Worcester, Mass.

It is a new seven-acre plant of Norton Company that has grown up making better products to make other products better. We believe it is the most modern plant of its kind in the world. It will help us serve our many customers better.

However, in a larger sense we see this as much more than the mere opening of an additional plant. It symbolizes the Norton attitude toward American industry of the future. As the demand for greater precision and finer finish in products increases, the part grinding and lapping plays becomes more important. We think that we are actually anticipating industry's needs in this new plant - not merely keeping in step with progress.

We often speak about Norton Grinding Machines and Wheels giving your men in the shop the "Touch of Gold". This means that every time a Norton wheel on a Norton machine grinds a product in process it adds to its value and usefulness. You add to your profit margin without having to add to price. It is part of the American way of making goods better, faster, at lower cost. That is what this new plant is for.

This new plant will enable us to turn out better grinding machines in shorter time. We have greatly regretted that some customers have had to wait for certain types of machines, but we think that their patience will be rewarded by the finest machines we have ever produced in our half century of business. Deliveries are improving as the expanded facilities come into full use and we should now be able to meet all of your requirements.

Please accept this as a personal invitation to visit us at Norton Company any time you are in New England. We feel sure you will find it interesting, inspiring and rewarding.

Sincerely yours,

NORTON COMPANY

Milton P. Higgins

President

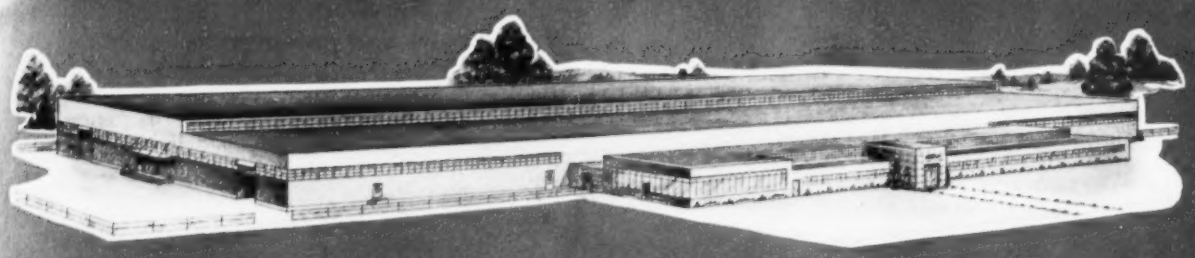
Opening New Doors to the Future...

to Give Industry the

"TOUCH OF GOLD"

You are cordially invited

...to the Grinding Machine Division's New Home



Your Norton Man Knows. He will be glad to talk with you at a planning level basis. As you look to the future in your own business, you can call upon the world's largest source of grinding machines, abrasives and abrasive products for the most recent developments in grinding operations. Or, if you wish, write direct for more information on any project you may now have under consideration. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

ONLY NORTON OFFERS YOU OVER 50 YEARS OF COMBINED EXPERIENCE IN:

ABRASIVES AND GRINDING WHEELS

PLUS

MACHINES FOR

Cylindrical Grinding • Surface Grinding
Cylindrical and Flat Lapping
Universal Tool and Cutter Grinding
Universal Multipurpose Grinding
Specialized Grinding • Crankshaft Grinding
Cam Shaft and Contour Grinding
Roll Grinding

FREE-FLOW PRODUCTION is the method employed in this new Norton plant. This is a scene in the production line for medium weight parts. Note how freely material-handling trucks can move in and out — how accessible the work is — how openness, controlled ventilation and perfect light add to workers' efficiency and morale.

NORTON *Making better products to make other products better*

NORTON COMPANY, MACHINE DIVISION, WORCESTER 6, MASS.

District Sales Offices: Hartford • New York • Cleveland • Chicago • Detroit
In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5

Printed in U. S. A.

another reason why owners say —

"We use the VERS-O-TOOL SYSTEM"

They call it a "system" because, among other exclusive features, Vers-o-tools are provided with a patented Namco Micrometer that takes the guess-work out of chaser grinding.

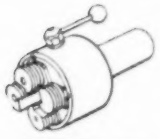
No trial cuts, no adjustments, no time or scrap loss. And by providing an extra set of chasers, kept ground in the toolroom and ready, you put long run jobs on a continuous production basis. Time saved by using this gage frequently adds thousands of precision threads—reduces your costs.

Other Advantages of the System

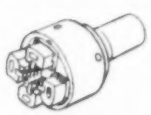
Standard Vers-o-tools use either the famous ground thread circular chasers or the lower cost, adjustable-blade, ground thread chasers—interchangeable die size for die size, in both revolving and non-revolving self-opening heads. The same system applies for end forming and end turning cutters. Use of knurls and rolls is common practice.

Once you start using Vers-o-tools, you are immediately equipped for a more versatile use of threading equipment, at a lower tool investment, than is possible from any other source.

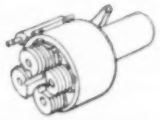
Ask for DT-52, complete new catalog on Vers-o-tool and Namco Solid and Collapsible Taps.



Style DS Vers-o-tool (Non-revolving Type) 10 Sizes, 3/8"—6½".



Style DR Vers-o-tool (Revolving Type) 13 Sizes 1/8"—6½" Shown with Adjustable Blade Chasers 7 Sizes, 1/8"—2".



Style DBS Vers-o-tool (for B&S Automatics) 3 Sizes, 1/4"—1/2".

Patented NAMCO MICROMETER

takes the guess-work out of chaser grinding

THIS IS THE WAY IT WORKS:

★ Remove chasers from Vers-o-tool head (in one minute) and take a micrometer reading.

★ Regrind them to the same micrometer reading. (Perfect control of the grind is automatic through serrated mounting of circular chasers—rechecking on the gage proves their uniformity.)

★ Replace chasers in head (one minute) with *certainty* that they will cut threads *identical* to those cut on previous grinds.

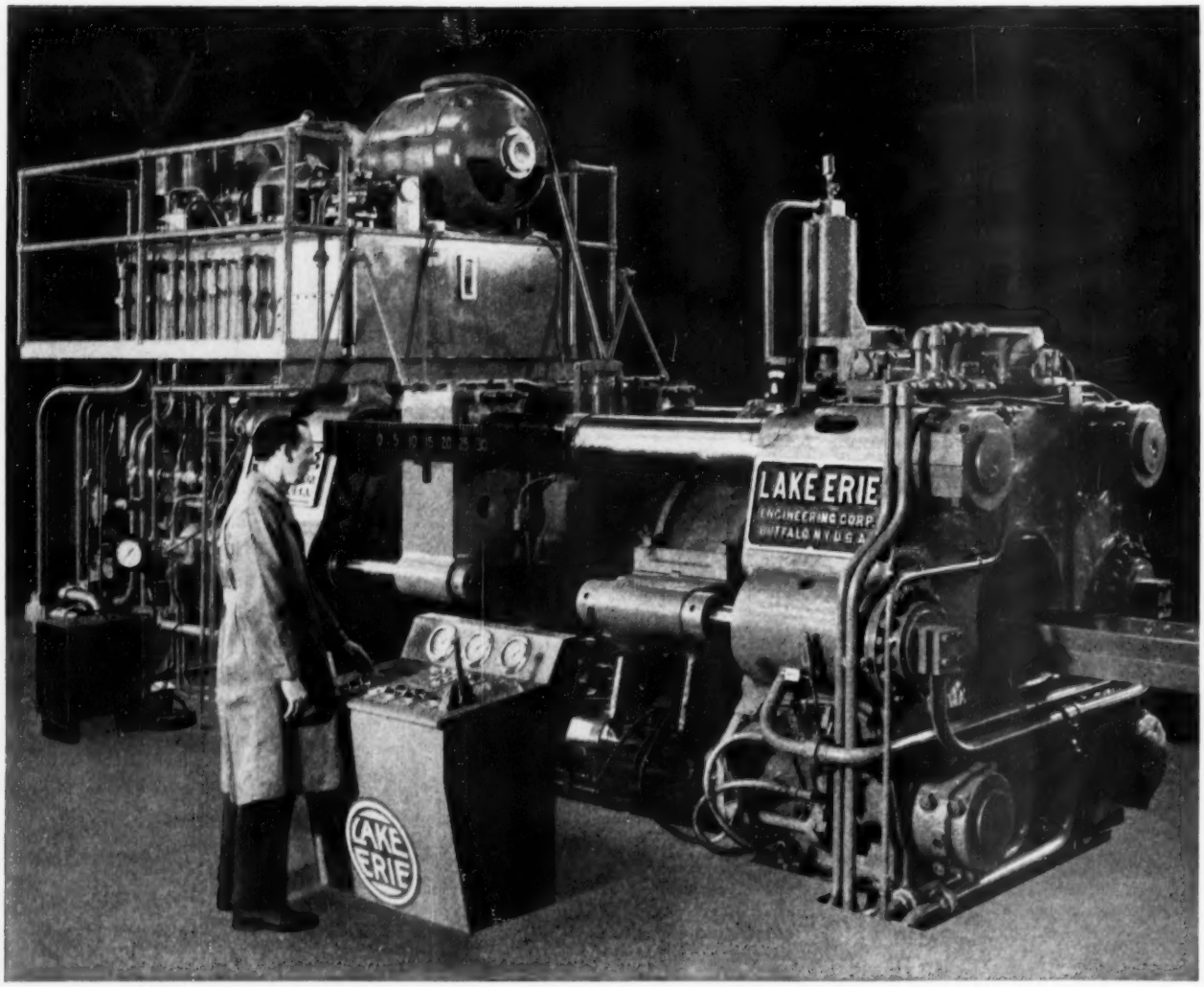
24-HOUR DELIVERIES ON MOST STANDARD STOCKABLE NC AND NF CHASERS AND BLOCKS — ALSO NATIONAL TAPER PIPE AND DRY SEAL

The NATIONAL ACME CO.

170 EAST 131 STREET, CLEVELAND 8, OHIO.

Acme-Gridley Bar and Chucking Automatics, 1-4-6 and 8-Spindle — Hydraulic Thread Rolling Machines — Automatic Threading Dies and Taps — Limit, Motor Starter and Control Station Switches — Solenoids — Contract Manufacturing

BIGGEST NEWS OF THE



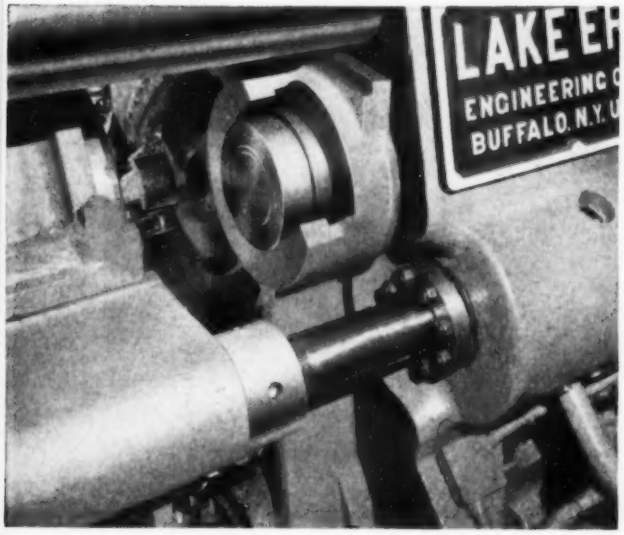
THE 1250 TON LAKE ERIE extrusion press has a self-contained pumping unit and electrically heated container. Elimination of the gate lock and die runout table make this design far more compact and rigid. New swinging die arm illustrated on opposite page takes their place.

7 MAJOR FEATURES REVEALED

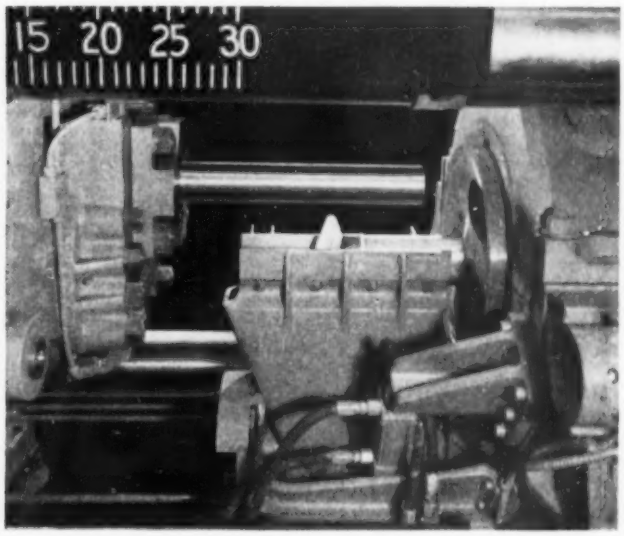
1. New swinging die arm eliminates gate lock and die runout table... speeds die changing...greatly reduces maintenance.
2. Shorter stroke increases speed and decreases maintenance.
3. Container supported on center-line of press prevents changes due to heat expansion.
4. Loader for billets and dummy blocks simplified.
5. Special control permits exact speed adjustment to suit the work.
6. Interlocks prevent accidents.
7. More compact design saves large floor area...increases rigidity of press.

DAY FOR EXTRUDERS...

the most important improvements in extrusion press design in years!



VIEW SHOWING the swinging die arm which pivots about one of the lower columns. "Horseshoe" cavity at top of swinging die arm carries the die holder with the die and separate backup block.



THE BILLET LOADER is of simple, unique construction consisting of a V-block mounted on an arm pivoted on the vertical centerline of the press. The extrusion stem is mounted on a vertical slide.

By combining experience in non-ferrous extrusion press construction with that in the related fields of hot and cold steel extrusion, Lake Erie engineers have come up with the most important improvements in extrusion press design in years. The 7 big features culminate two years of intensive research and development work. This includes the construction and operation of a test installation, and an actual production demonstration for extrusion engineers and executives from leading plants. Here is machine development at its best—the retention of fundamental design...the application of improvements based on related experience...the development and testing...and finally the actual demonstration of results. By all means, see for yourself what this superior type of non-ferrous extrusion press can do for you. Write or call us.

LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

MANUFACTURERS OF HYDRAULIC PRESSES AND DIE CASTING MACHINES

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LAKE ERIE HYDRAULIC PRESSES are available in any size . . . standard, modified and special designs—horizontal and vertical types—for Metal Working—Plastics Molding—Forging—Metal Extrusion—Processing—Vulcanizing—Laminating—Stereotype Molding—Matrix Forming—Briquetting—Baling—Special Purpose.

District Offices in NEW YORK • CHICAGO • DETROIT • PITTSBURGH
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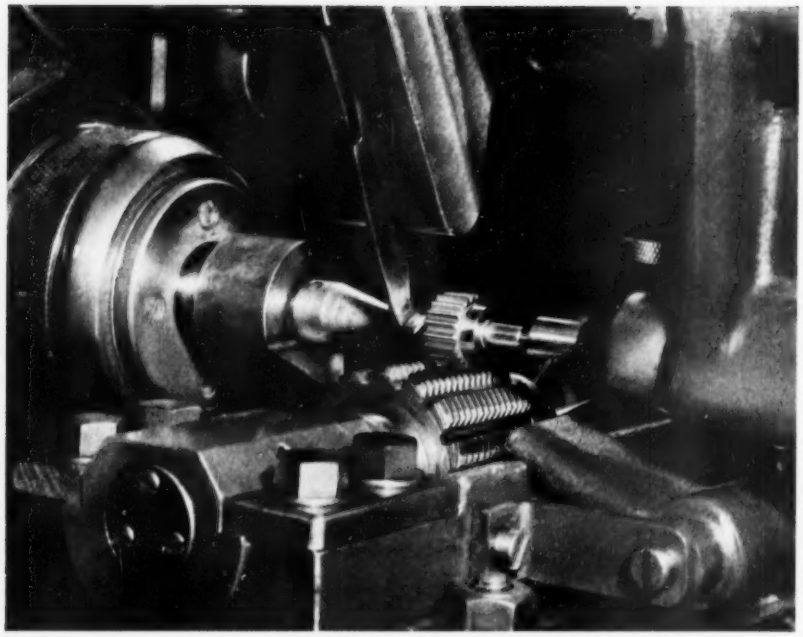
LAKE ERIE ®



COMBINE ACCURACY and PRODUCTION on your HOBBING OPERATIONS

Barber-Colman Hobbing Machines have a basic design which makes it possible for them to be easily tooled to give the required accuracy at the desired production rate. Each job is considered individually to provide maximum efficiency according to your specifications. The machine and tooling are combined to give you maximum production commensurate with the desired accuracy.

An example of the tooling which is available for high-speed hobbing is the high-speed hob swivel with speeds as high as 1800 rpm. Although most jobs cannot utilize these high speeds, this swivel can increase production considerably under the proper conditions. Multithread hobs, quick-acting tooling and automatic loading can also be applied to many high production jobs.

For maximum accuracy, special precision No. 6-10 and No. 16-16 machines are available. These machines are equipped with single-thread index worms to provide maximum tooth spacing accuracy, and the relative rotation of the hob and work spindles is held to precision tolerances. These machines equipped with Barber-Colman Class AA hobs are capable of cutting the very finest hobbed gears at relatively high production rates. Whatever your hobbing problems may be, Barber-Colman has the equipment to satisfy your needs.

BUILDERS OF PRECISION GEAR

ACCURACY

This 26 D.P. 7-tooth pinion has an outstanding record for both accuracy and production on a Barber-Colman No. 6-10 Hobbing Machine. The feed is .050″ per revolution of the work spindle. Speed of the 2″ diameter hob is 533 rpm cutting B 1113 steel with a double-thread hob. Cutting time for the ¾″ face width is less than ten seconds, and 18,000 pieces are obtained per sharpening of the hob. The maximum adjacent tooth spacing error is .0002″, and concentricity is easily held within the tolerance of .0015″.

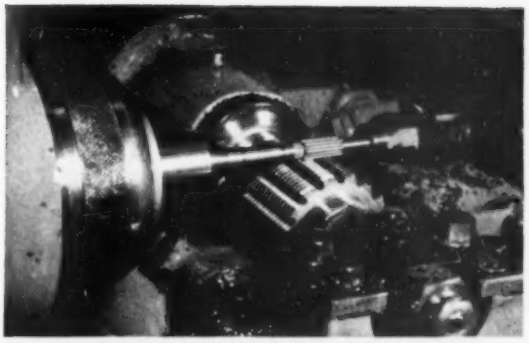
PRODUCTION

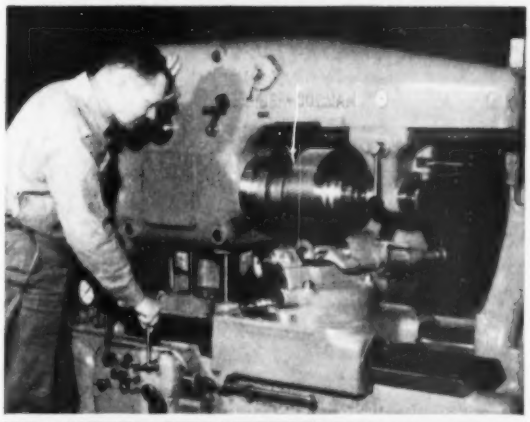
Semi-finish hobbing of these 8 D.P. change gears with 84 teeth is accomplished on a Barber-Colman No. 14-15 Hobbing Machine with a feed of .075″ per revolution of the work spindle. With a five-thread hob, the cutting time per load of two with a 4″ face width is 16.6 minutes. Using a single-thread hob on this job required a cutting time of 66 minutes per load of two. Therefore, although the hob speed is only 105 sfm on a NE8749 steel blank, cutting time was reduced by 75% while maintaining the required accuracy.

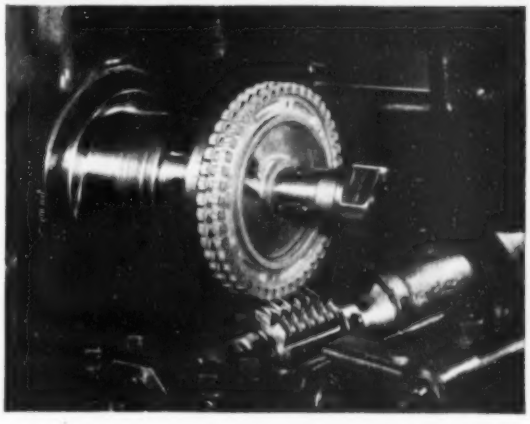
SPECIAL FORM

Form accuracy of the slots on this wheel is important. Hobbing generates the slots with straight and parallel sides having no taper and a minimum undercut of .0005″. Spacing accuracy of the Barber-Colman No. 6-10 Precision Hobbing Machine holds the accumulated spacing error for the 45 slots within .001″. Production is five wheels per hour as compared with two per hour by the previous method.

For a quotation on your specific job, call your nearest Barber-Colman representative or send us a blueprint with the desired tolerances and production.







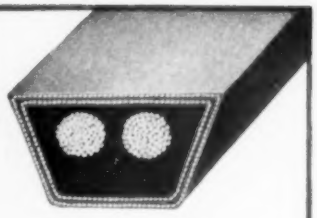
HOBS • CUTTERS • REAMERS
HOBBING MACHINES
HOB SHARPENING MACHINES

BARBER COLMAN

Barber-Colman Company

GENERAL OFFICES AND PLANT, 616 ROCK STREET, ROCKFORD, ILLINOIS

HOBS AND MACHINES SINCE 1911



***TEXROPE* Grommet V-Belts**—20 to 50% longer life than ordinary belts. Size for size, grommet belts give 1/3 more gripping power, pull heavier loads with higher safety factor.

STANDARD CAST IRON SHEAVES — Made to order from stock patterns. One to 14 grooves for A, B, C, D or E belts. One to 1000 horsepower. Split sheave or split hub.

***MAGIC-GRIP* SHEAVES** — Semi-steel casting with interchangeable, patented taper bushings. On and off in a jiffy. Cannot shake loose. Two to 12 grooves for B, C and D belts; 2 to 250 hp.

Everything in V-Belt Drives

from one reliable source!

ALLIS-CHALMERS HAS BOTH the engineering experience and the drive equipment to lick the most unusual problems. Your special problems are carefully analyzed by a staff of experienced application engineers familiar with your industry. The result — the right drive for the job! Call your nearby Allis-Chalmers distributor or district office for help on your drive problems, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4087

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MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

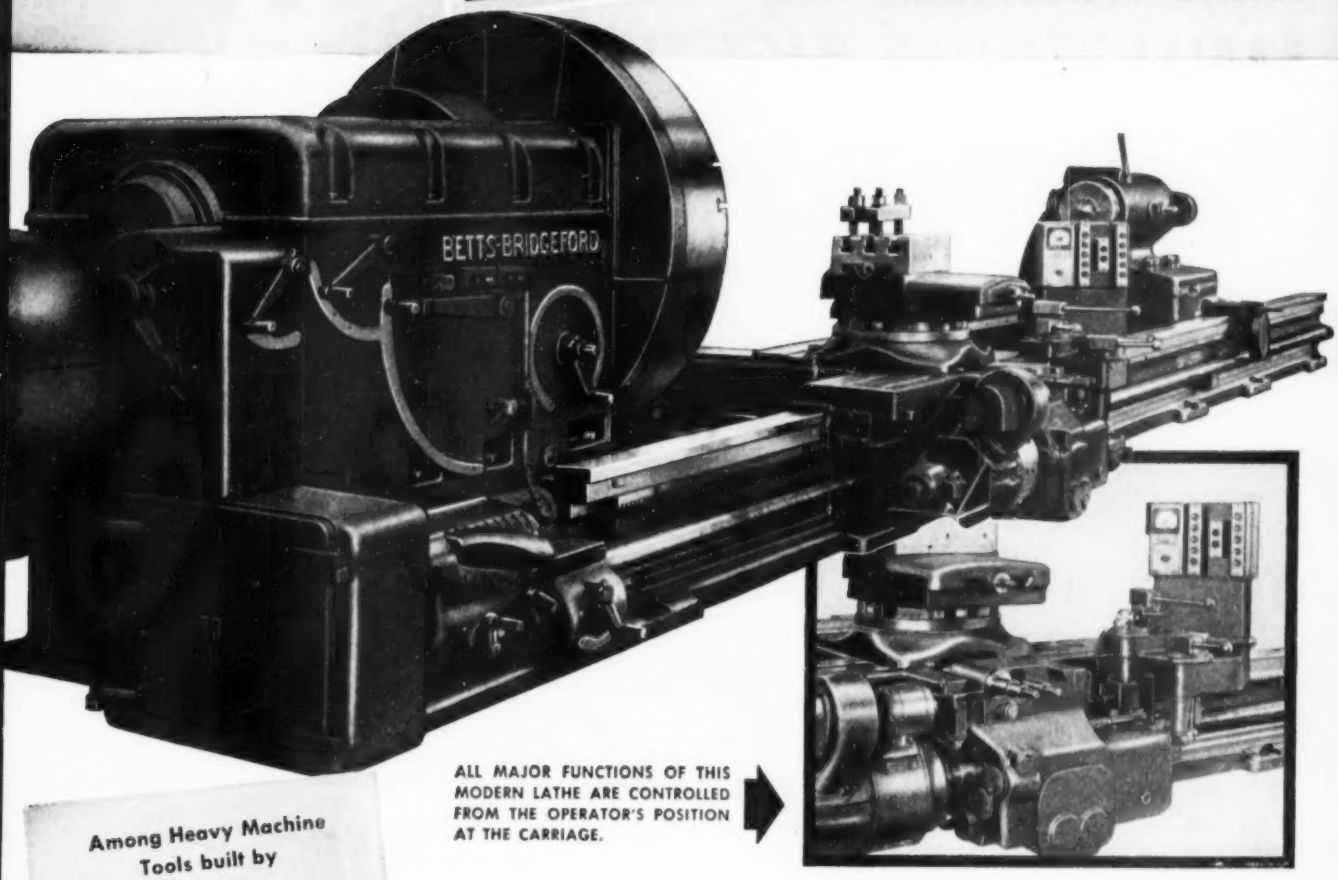
PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

ALLIS-CHALMERS

BETTS-BRIDGEFORD

ELECTRONIC FEED

60" HEAVY DUTY LATHE



ALL MAJOR FUNCTIONS OF THIS MODERN LATHE ARE CONTROLLED FROM THE OPERATOR'S POSITION AT THE CARRIAGE.

Among Heavy Machine Tools built by Consolidated are . . . .

LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
BORING, DRILLING AND MILLING MACHINES
DRILL AND TOOL GRINDERS
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER SPECIAL MACHINES

- Wide speed range permits use of either high speed steel or carbide tools.
- Feed and traverse functions entirely independent of thread cutting mechanism.
- Feed rate and cutting speed, within the range of their respective motors, are adjustable independently without interrupting the cut.
- Lead screw for thread cutting only.
- All anti-friction bearing headstock.
- Hardened steel bedways.
- Main drive motor speeds and feed and traverse functions are conveniently controlled from the operator's position at the carriage.

Altogether, this modern lathe embodies the advanced features necessary to meet today's demand by industry for high production with greater accuracy and durability. Full information on this lathe or other Betts-Bridgeford Heavy Duty Lathes from 26" to 144" and larger will be furnished upon request.

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848

BETTS • BETTS-BRIDGEFORD • COLBURN • HILLES & JONES • MODERN • NEWTON • SELLERS

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

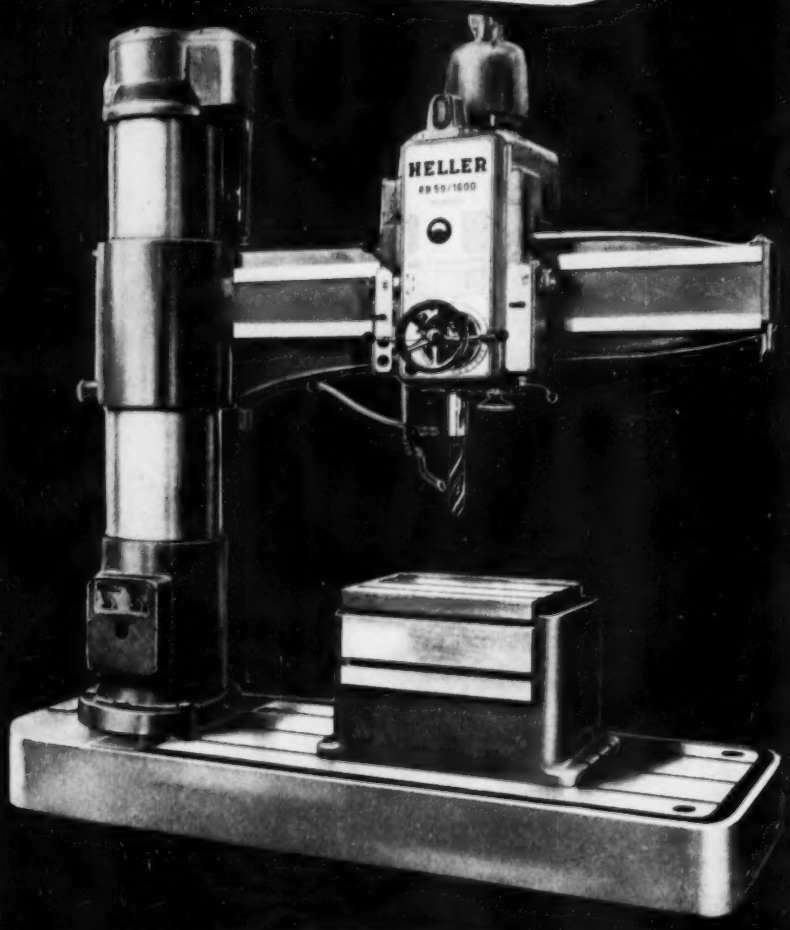
SUBSIDIARY OF FARREL-BIRMINGHAM COMPANY, INCORPORATED

ROCHESTER, NEW YORK

Cut Costs and
Increase Efficiency with

HELLER

RADIAL DRILLING MACHINES



HELLER MACHINE CO.
114 Liberty St., New York 6, N. Y.

KNEE & PLANER TYPE MILLING MACHINES
COLD SAWING MACHINES • SAW SHARPENING MACHINES • SAW BLADES • TRANSFER MACHINES • SPECIAL MACHINES

Heller Radial Drilling machines are offered in 2½ foot, 4 foot and 5 foot arm types. Column is 16" in diameter and drive is by direct motor through multi-disc friction clutch. Gear change is simplified through pre-selector unit with automatic depth drilling and tapping switch. Arm raising and lowering and saddle adjustment is hydraulically locked as desired. Construction is complete with anti-friction bearings with special oil pump for saddle lubrication. In addition to Radial drills, we offer also Column Drilling Machines and Gang type drilling machines.

Importing Heller Machines Since 1926

ARMSTRONG

Modern Tooling Calls for *the Correct*

ARMSTRONG TOOL HOLDERS for each operation

In the old days it was a matter of pride with toolmakers to be able to do the work at hand with the tools at hand. It's a credit to their skill that they could devise to cut threads, do cutting-off and facing, as well as many other operations with one ARMSTRONG TURNING TOOL, but, at today's labor cost, this would be an expensive practice. The maximum of productive work and true machining efficiency can only be obtained by providing the correct ARMSTRONG TOOL HOLDERS for each operation.

The Armstrong System of Tool Holders provides specially designed ARMSTRONG TOOL HOLDERS for every operation on lathes, planers, slotters, and shapers . . . Turning Tools, Boring Tools, Threading Tools, Knurling Tools, Cutting-Off Tools; tool holders with straight shanks, with off-set shanks, rigid tools and "spring" tools . . . special tool holders for high speed steel bits or blades, for ARMIDE (carbide-tipped) Cutters, for ARMALOY (cast alloy) Bits and Blades.

These modern efficient ARMSTRONG TOOL HOLDERS are as available as your telephone for they are carried in stock by your local ARMSTRONG Distributor.

ARMSTRONG BROS. TOOL CO.

"THE TOOL HOLDER PEOPLE"

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You can make it yourself, like this...

or buy it from Mallory, like this...

and get a better tip for less money

"Home made" resistance welding electrodes can be expensive—not only because of the time they cost but also because of limited strength, poor conductivity and inadequate cooling.

Both double and single bend electrodes in a wide range of shapes are available from Mallory stock. They are cold formed, from full hard rod stock, retaining maximum physical and mechanical properties... and with cooling tubes bent in place* to bring effective cooling close to the welding face. All this means long electrode life for uninterrupted production runs.

Don't resort to makeshift arrangements for your welding applications, no matter how special they are, until you check with Mallory. Holders and electrodes are available in a wide variety of shapes and sizes from stock ... standard parts that can be combined to handle practically any job. Ask your Mallory Distributor, or write us directly, for your copy of Catalog 550C. See for yourself the almost limitless combinations of standard welding items that are quickly available.

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*Patent No. 2489993

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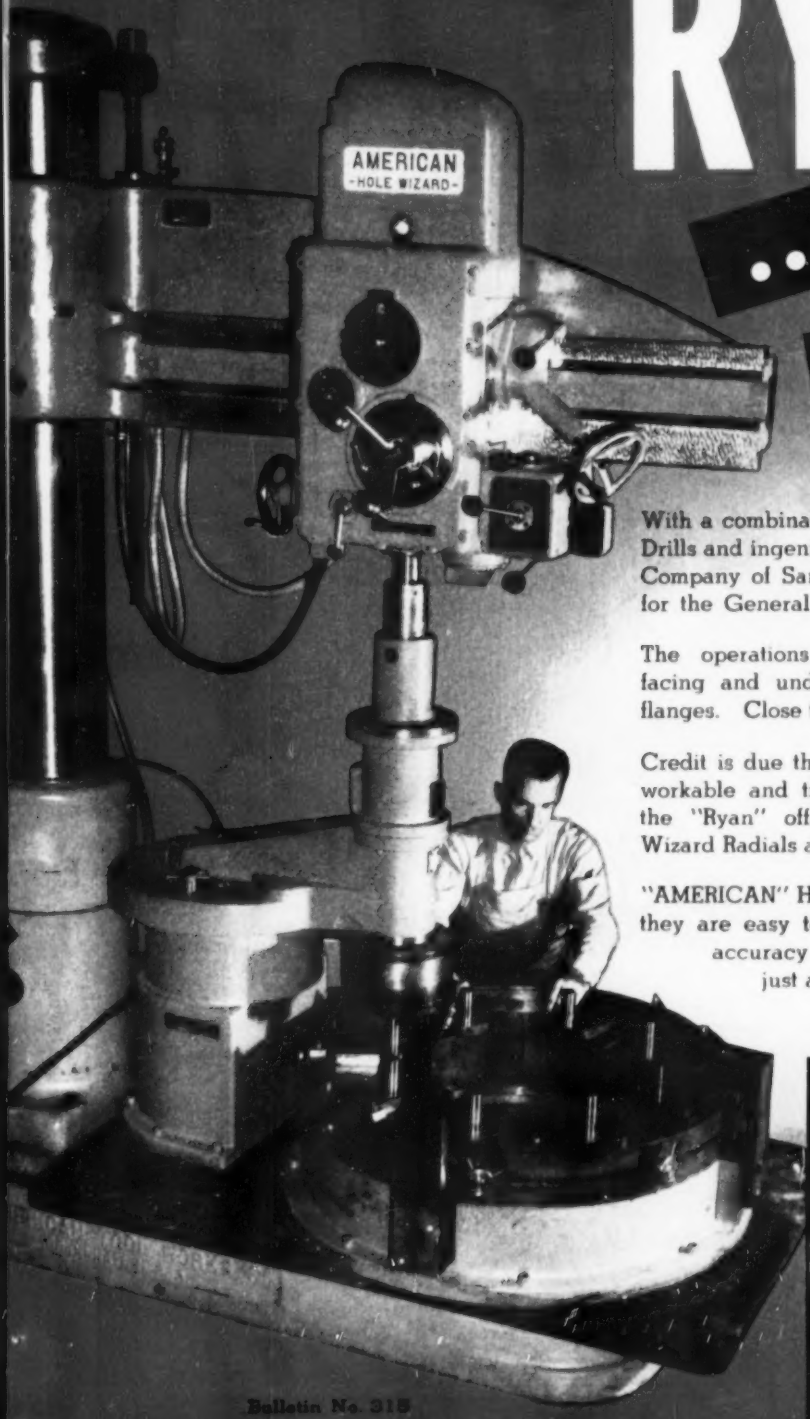
For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio

RYAN ...HITS THE JACKPOT!

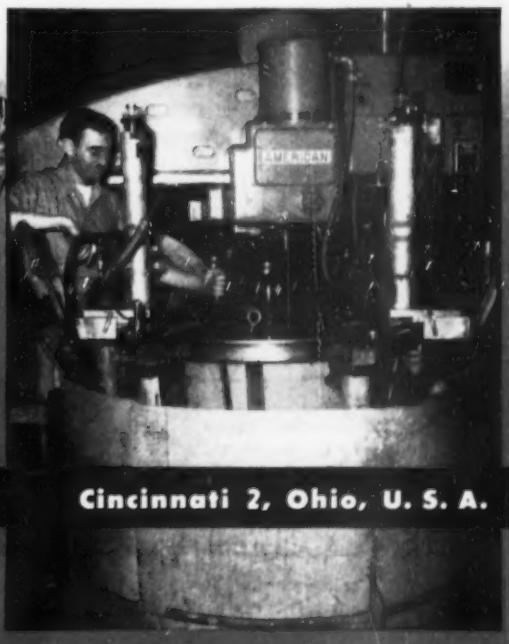


With a combination of "AMERICAN" Hole Wizard Radial Drills and ingeniously designed fixtures Ryan Aeronautical Company of San Diego, California, produces Aft Frames for the General Electric J-47 jet engine in record time.

The operations performed include precision boring, facing and undercutting of the stainless steel support flanges. Close tolerances must be and *are* held.

Credit is due the "Ryan" engineers for developing such workable and time saving fixtures. Credit is also due the "Ryan" officials for selecting "AMERICAN" Hole Wizard Radials as part of the "winning combination."

"AMERICAN" Hole Wizards are sturdy; they are powerful; they are easy to operate and they retain their original accuracy for years to come. For substantiation just ask the operator.



Bulletin No. 315 will give you the facts

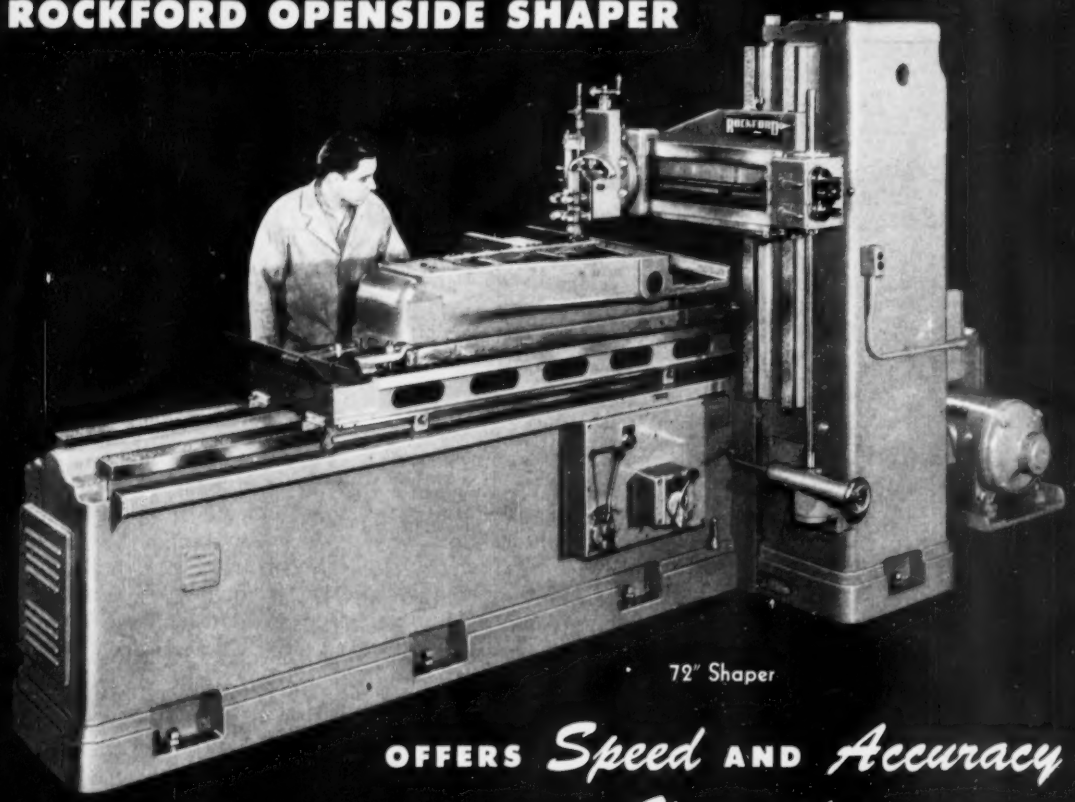
THE AMERICAN TOOL WORKS CO.

LATHES AND RADIAL DRILLS

Cincinnati 2, Ohio, U. S. A.

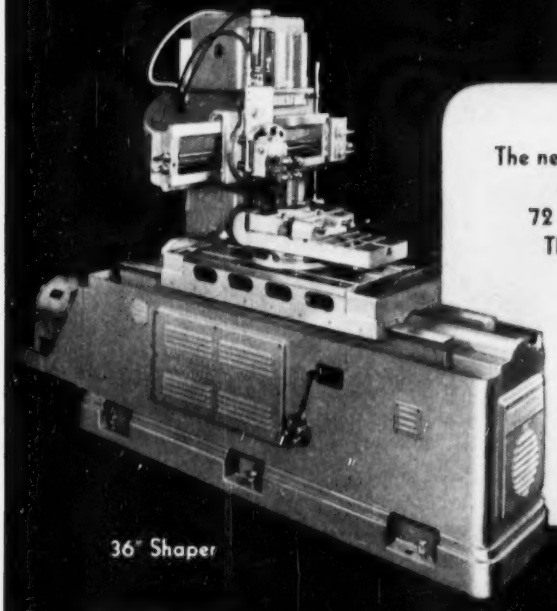
NEW.....

ROCKFORD OPENSIDE SHAPER



72" Shaper

OFFERS *Speed* AND *Accuracy*
PLUS *Versatility*



36" Shaper

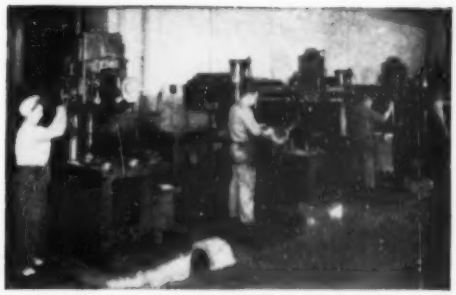
The new 72" Rockford Openside Shaper gives you best results on *all* shaper jobs — with stroke lengths up to 72 inches.

This "big brother" of the Rockford Openside Shaper family (36", 48", 60", 72") has all the superior features of companion models, *plus* increased capacity. It's the maximum in versatility — large-job capacity with no sacrifice in speed or accuracy. And It's *Hydraulic* . . . of course.

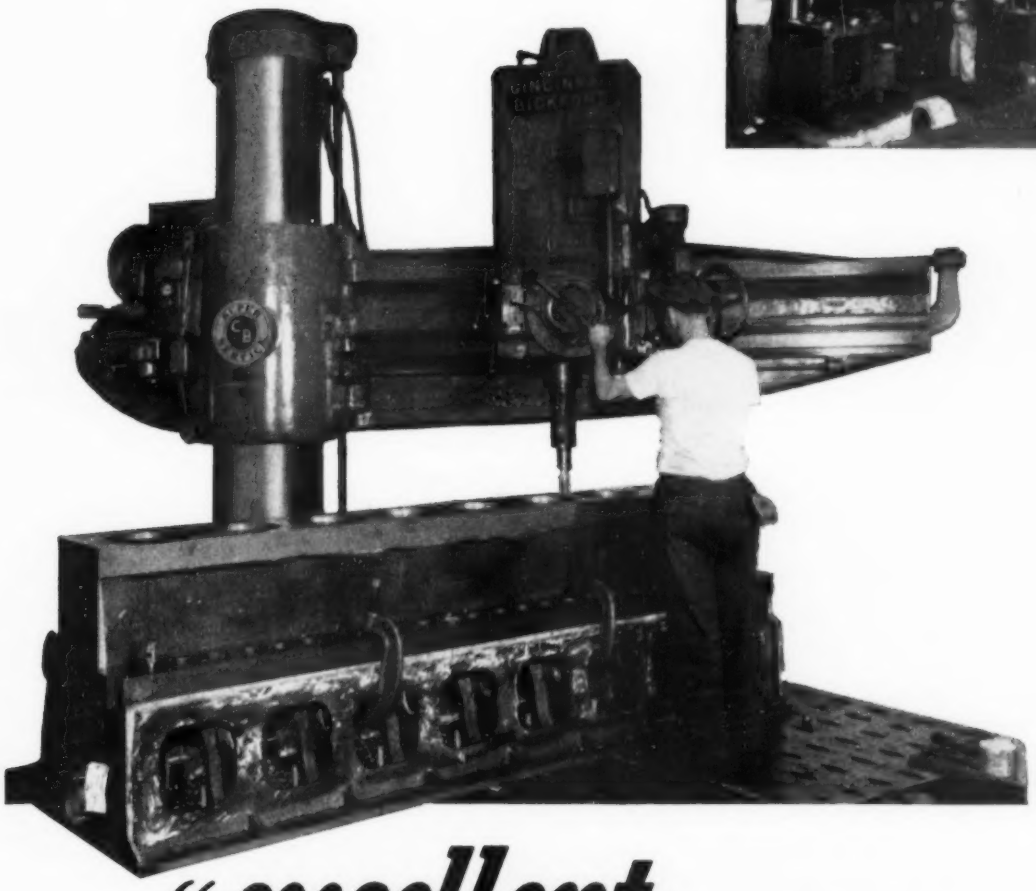
Before you invest, investigate the new 72" Rockford Openside.

Hy-Draulic

ROCKFORD MACHINE TOOL CO.
2500 Kishwaukee Street • Rockford, Illinois



This battery of Cincinnati Bickford Super Service Radial Drills is drilling, tapping and reaming smaller parts.



"excellent in all respects..."

The ease of handling, the performance, accuracy and speed of the 7' arm, 19" diameter column Cincinnati Bickford Super Service Radial Drills "rated excellent in all respects."

The job involved drilling, tapping, reaming of 43 holes in a large diesel cylinder block.

A battery of smaller Cincinnati Bickford Super Service Radial Drills is also giving "excellent" performance.

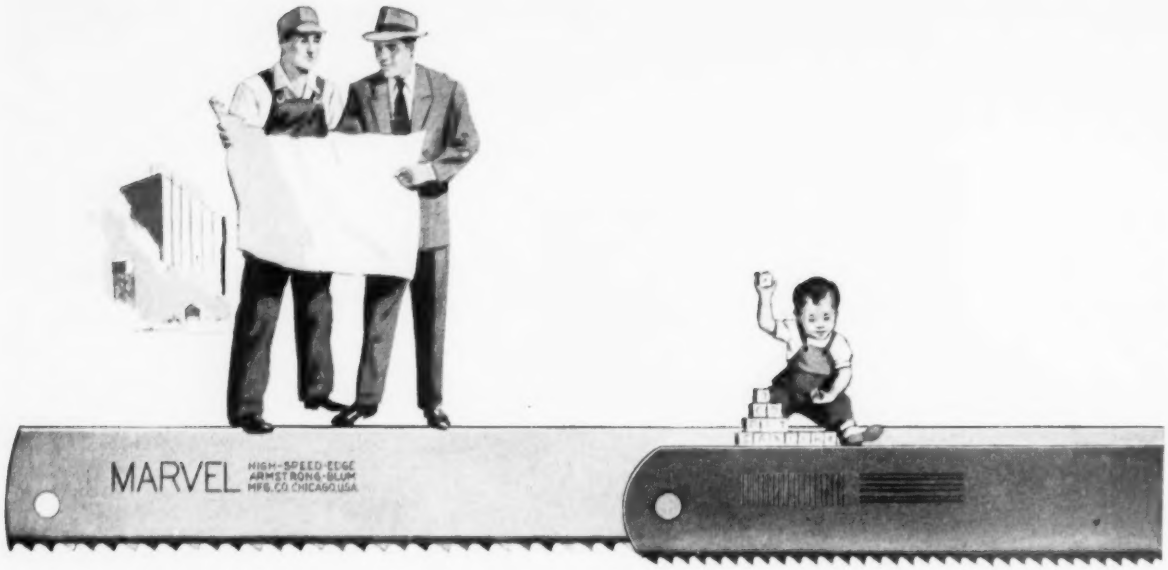
Write for descriptive circular of these fine machines.

CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.



. . . *but*
Experience Cannot be Copied

More than a quarter-century ago MARVEL invented and basically patented the MARVEL High-Speed-Edge Hack Saw Blade—the UNBREAKABLE blade that increased hack sawing efficiency many-fold.

Every MARVEL Hack Saw Blade ever sold has been of that basic welded high-speed-edge construction, with constant improvements from year to year, as EXPERIENCE augmented the "know-how" . . .

MARVEL is not "tied" to any single source of steel supply, and has always used the best high speed steels that became available from time to time as metallurgy progressed. When-as-and-if finer steels are developed—and are proven commercially practical for welded-edge hack saw blades—MARVEL will use them, regardless of cost or source . . .

There is only one genuine MARVEL High-Speed-Edge! All other "composite" or "welded-edge" hack saw blades are merely flattering attempts to imitate — without the "know-how" of MARVEL EXPERIENCE . . .

Insist upon *genuine* MARVEL High-Speed-Edge when buying hack saw blades—and be SAFE, for you can depend upon MARVEL. They have been "tested", "pre-tested", and "re-tested" by thousands of users for more than a quarter-century!

MARVEL *Metal Cutting* **SAWS**

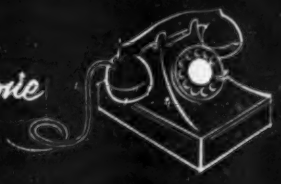
Better Machines-Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 Bloomingdale Ave. • Chicago 39, U. S. A.

Red Shield says:

"STANDARD for tough jobs since 1881"

as near as your telephone



Call your Industrial Supply Distributor for Shield Brand End Mills. Specialized factory service available everywhere.

STANDARD TOOL CO.

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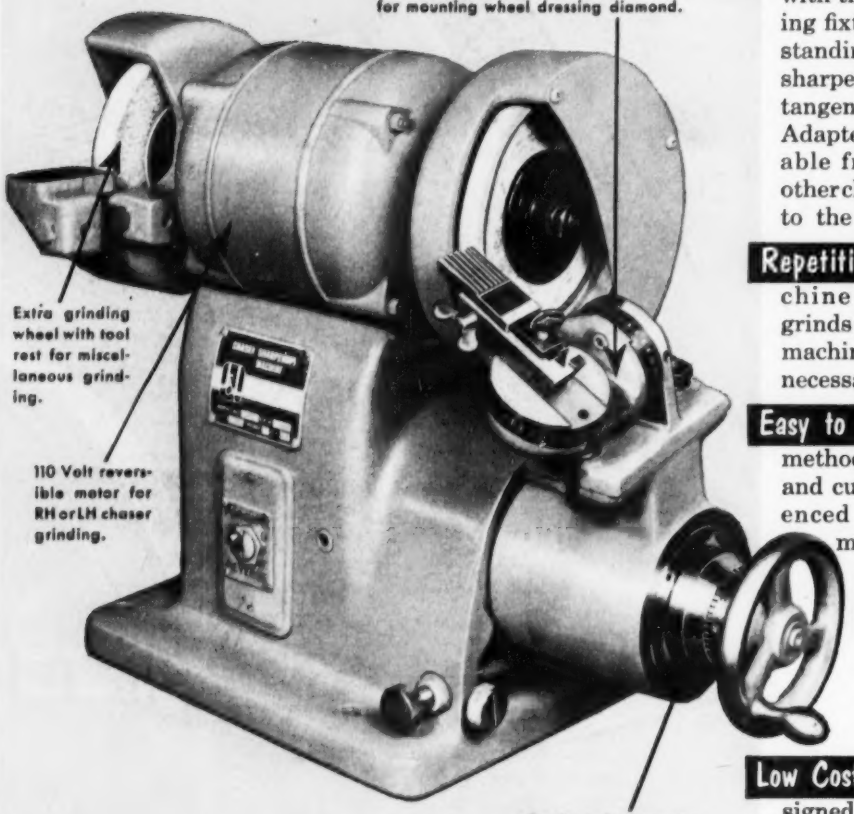
THE STANDARD LINE: *Twist Drills · Reamers · Taps · Dies · Milling Cutters · End Mills · Hobs · Counterbores · Special Tools*

NEW

JONES & LAMSON UNIVERSAL BENCH TYPE CHASER SHARPENING MACHINE

Specifically designed to resharpen chasers, this *Low Cost,* space saving machine allows you to free heavy expensive machine tools for their intended uses, and at the same time do a better job of chaser sharpening. *It's good for miscellaneous small tool and cutter grinding too.*


J & L Universal Grinding Fixture with tangent chaser. Basic fixture has provision for mounting wheel dressing diamond.
Extra grinding wheel with tool rest for miscellaneous grinding.
110 Volt reversible motor for RH or LH chaser grinding.
Graduated micrometer dial to control infeed.

Grinder set up to resharpen J & L Tangent chasers

Universal Application Equipped with the new J & L chaser grinding fixture and adapters, an outstanding job will be done on all sharpening operations, for both tangent and radial die chasers. Adapters for J & L chasers available from stock. Adapters for other chasers can easily be applied to the chaser grinding fixture.

Repetitive Accuracy This machine will duplicate desired grinds repeatedly. It is a precision machine tool equipped with all necessary stops and controls.

Easy to Operate Simple, direct methods speed up the operation and cut costs. Even an inexperienced operator can, in a few minutes, learn to resharpen chasers on this machine.

Saves Space BENCH SPACE 14 x 28 inches is ample for your complete chaser resharpening operation.

Low Cost This complete unit, designed to do your entire chaser resharpening job, sells for only a small fraction of the cost of other bulkier machines often used. Why not install one in your plant, and release your heavier, bulkier machines for their intended uses?

P.S. *Because of its size this machine can well be a time saver in shops where cutter grinding rooms are at distant points from the machines where dies are used. Write Dept. 710G for further details.*

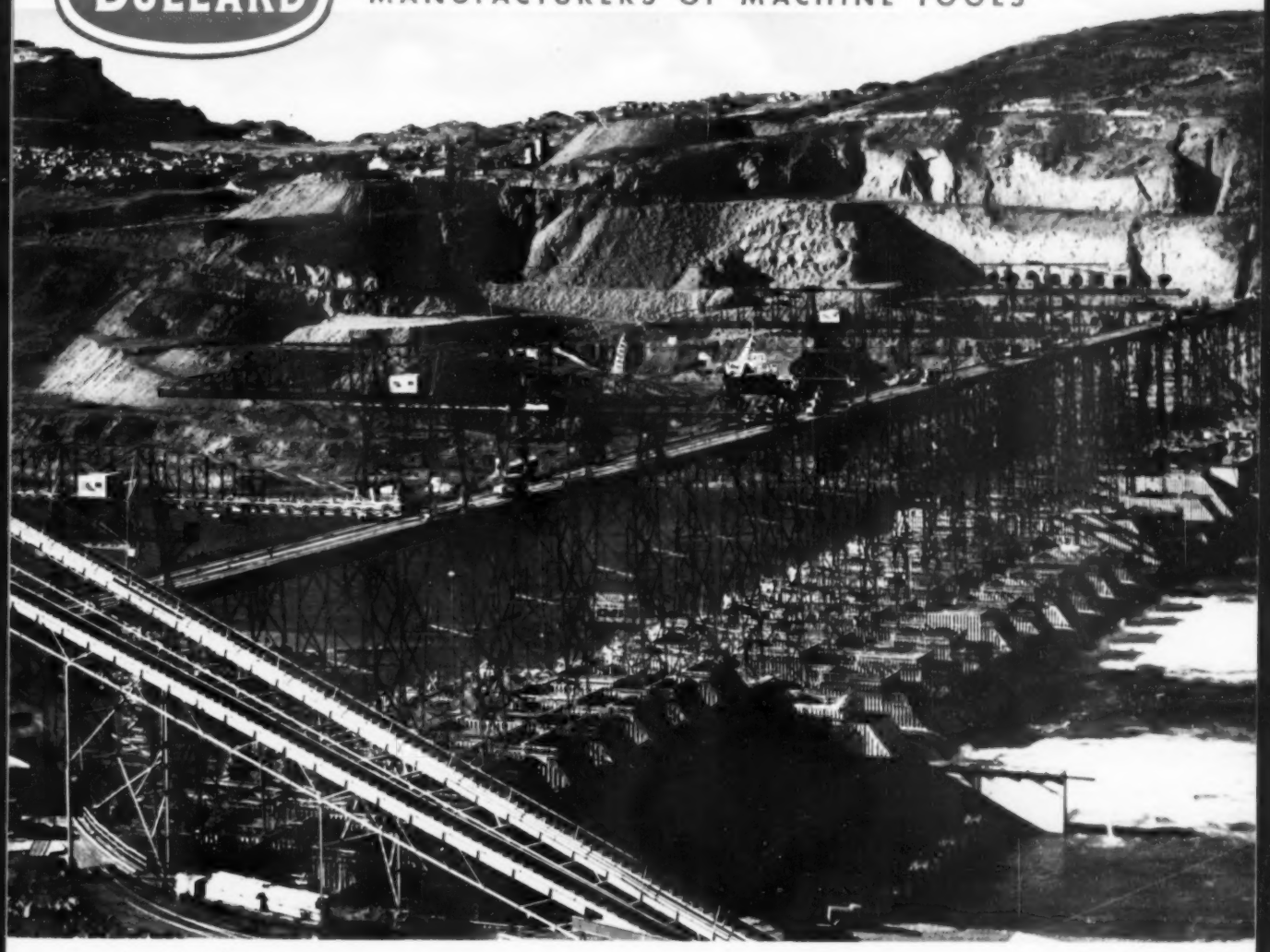
JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 502 Clinton St., Dept. 710, Springfield, Vt., U.S.A. **DIE HEAD DIVISION**

BULLARD

MANUFACTURERS OF MACHINE TOOLS



Construction of Grand Coulee Dam — Wide World Photo

The Invisible Background of Industrial Progress

The influence of an engineering project such as the Grand Coulee Dam reaches far into many diversified industries. Located on the upper Columbia River in the state of Washington, this Dam covers 35 acres of land with its 25,000,000 tons of solid reinforced concrete. Such developments as this provide flood control, irrigation of previous waste lands, generation of power, increased employment and many other benefits that are plus factors in our American economy.

Construction of these huge projects requires many varied types of equipment as well as the numerous internal electrical, hydraulic and mechanical components, for which machine tools are the key manufacturing units.

★ The Bullard Company, builders of *Modern Machine Tools*, have consistently engineered and developed key manufacturing units for our American industries.

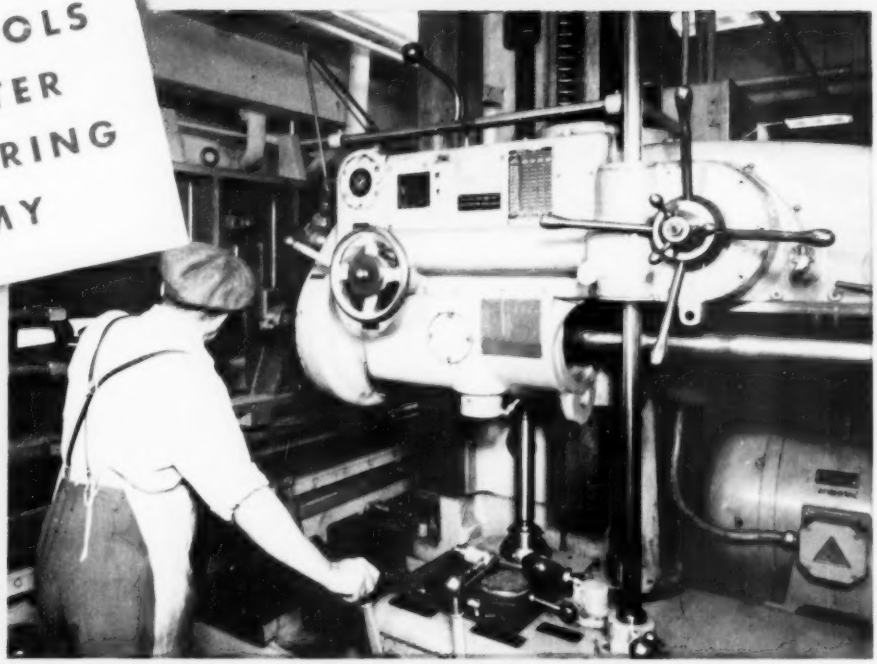
For small run jobs or mass production, Bullard Machine Tools will add a plus factor to your production economy.

★ *For greater manufacturing economy REFER to next page.*

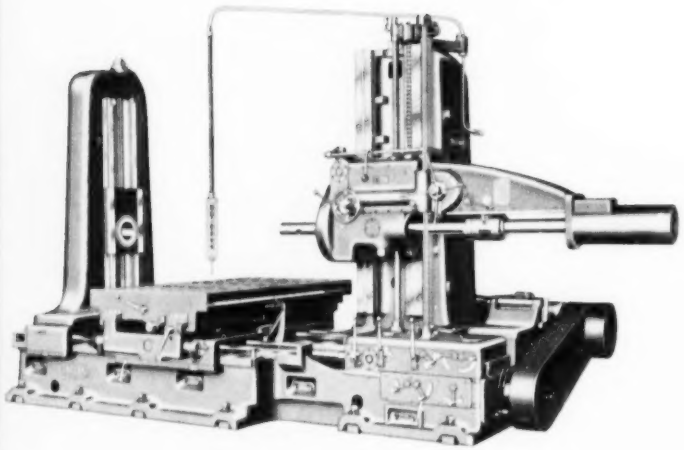
THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT

BULLARD MACHINE TOOLS FOR GREATER MANUFACTURING ECONOMY



The Bullard improved design 4-Way Bed 4 inch and 5 inch spindle Horizontal Boring, Milling and Drilling Machines with a choice of Bed length, Post height and Table sizes assures economy and maintained precision for quality production.



Manufacturing costs of all products are directly related to the manufacturing methods used by the producer. Therefore, in today's competitive markets, modern machine tools are highly essential in obtaining the necessary production efficiency.

Bullard Machine Tools have always, and more than ever today, rate high in the assurance of manufacturing quality and economy.

Investment logic for improved manufacturing efficiency dictates the first consideration of American built machine tools.

The initial investment cost of Bullard machines with their low cost productive ability, outweigh the lower first cost of other similar machines.

BULLARD

Time saved is money earned. Write now for information on Bullard Horizontal Boring Machines.

THE BULLARD COMPANY BRIDGEPORT 2, CONNECTICUT

small in size but

BIG

in opportunity for SAVINGS

Just figure your assembly expense as compared to total production cost, and you'll see why. In some products it runs as high as 75%.

Cutting assembly costs is Parker-Kalon's specialty. You get a two-way savings. First, the Self-tapping Screw method, originated by P-K, permits you to save by eliminating needless operations. Second, with certified Self-tapping Screws of P-K guaranteed quality, you can make sure *planned* savings *pay off* on the assembly line.

A P-K Assembly Engineer will be glad to help you start making savings you've been missing. He'll call at your request. Parker-Kalon Corporation, 200 Varick St., New York 14.

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The Original **SELF-TAPPING SCREWS**

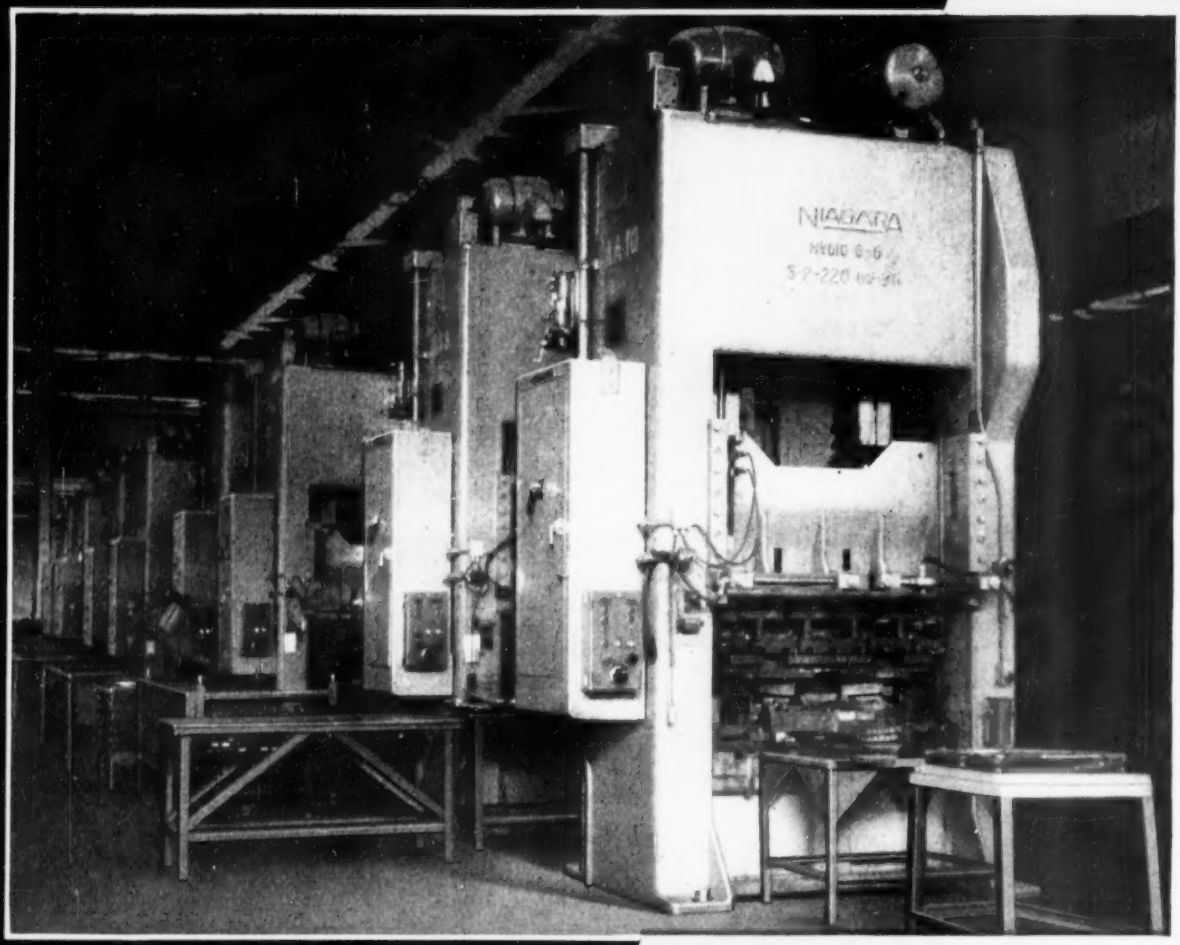
Sold through Industrial Distributors, the Supply Specialists that serve you

GET THIS NEW GUIDE TO LOWER ASSEMBLY COST

Filled with facts you need to make sure of a two-way saving when you plan assemblies. Ask your P-K Distributor, or write Parker-Kalon for Form 475-D.

*This mark △ on every P-K Self-tapping Screw identifies it as genuine.

NIAGARA



Typical production line of
Niagara Straight Side Double
Crank Presses in one of America's
foremost automotive plants

NIAGARA MACHINE & TOOL WORKS · BUFFALO 11, N. Y.

straight side double crank
PRESSES
Speeding up Production in Large Automotive Plants

Niagara advanced engineering features and modern streamline styling combine to make these presses leaders in their field.

- Electrically welded steel construction
- Air actuated electrically controlled sleeve and friction clutches
- Anti-friction bearing mounting for high speed shafts, flywheel and clutch wheels
- Gearing enclosed and running in oil
- Neither gearing nor shafting overhang the working area to block light and be a potential danger
- Single and double geared
- Single or double end (twin) drive
- Adjustable air counterbalance for slide
- Pneumatic draw cushions with adjustable pressure and surge tank
- Wide range of sizes and capacities
- J. I. C. features if desired

Write for catalog

Manufacturers of a complete line of sheet metal working equipment ranging from small hand tools up to large power operated machinery.

DISTRICT OFFICES: DETROIT • CLEVELAND • NEW YORK

We've put a new roof over an old part of our business

Now—with new, expanded facilities—we can offer you immediate help with your unusual metalworking problems, big or small

THOUGH we've been designing and building standard and special machine tools and tooling since 1898, limited production facilities for special machines have prevented us from offering these services on a wide scale.

But now, our Special Machinery Division has new and greatly expanded facilities. Its exclusive job will be to build special machine tools and tooling or to specially adapt standard equipment to solve specific metalworking problems.

Check our qualifications:

EXPERIENCE: We've been in the business 55 years. In addition to being one of the country's leading producers of standard milling machines . . . *our annual production of special machinery has ranged up to $3,000,000.*

FACILITIES: The new Special Machinery Division plant, built on a 38-acre site, is equipped with more than *$2,500,000 worth of new tools and equipment.*

PERSONNEL: The Special Machinery Division engineering section has nearly 100 experienced design and production engineers at its command. These men specialize in applying the latest developments in mechanics, hydraulics, electronics, metallurgy and allied fields to metalworking. In addition, it has a full complement of experienced machinists and mechanics needed for special machine construction.

PERFORMANCE: Kearney & Trecker's Special Machinery Division is best recommended by its record of successfully solving hundreds of unusual machining problems. These solutions required provision of high productive capacity as well as exacting dimensional accuracies and surface finishes.

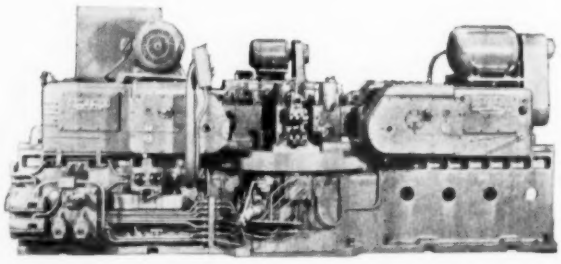
RESPONSIBILITY: Our Special Machinery Division is an integral part of the Kearney & Trecker Corporation . . . and is fully supported by all its financial, physical and personnel resources.

Any commitment for a product of this Division is a commitment that fully involves the accepted reputation for responsibility and satisfaction that is Kearney & Trecker's.

We invite your inquiry

We'll be glad to provide you with any information we can . . . including sample machine specification sheets on typical installations, a brochure covering the expanded facilities of our Special Machinery Division, and details on our Customer Engineering Service. Furthermore, if you have special production machinery problems, have one of our senior Project Engineers analyze them, without obligation, of course.

Write, wire or phone the Special Machinery Division, Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.

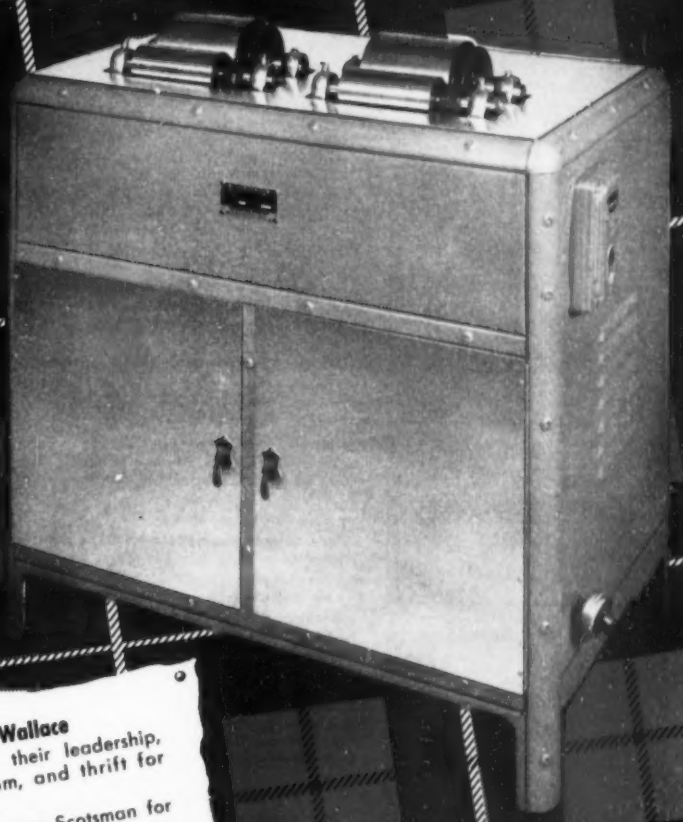


We've built special machines or adaptations of standard equipment for practically every industry. Here is a photo of a four-station rotary indexing machine we designed and built for a major automotive manufacturer.

KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS

1½ MICROINCH FINISH RMS

At Less Cost!



Today Size Control Centerless Lapping Machines are:

- ✓ Providing finishes of 1½ microinches or less and tolerances of .000005
- ✓ Lapping oversize bearings and gears
- ✓ Lapping and sizing bearing races, bushings, shafts and cylindrical parts

How They Are Saving Money for People Like You:

- ✓ Salvaging worn gages by reducing to next lowest size
- ✓ Saving shop space—dimensions are only 38" wide, 24" deep, 36" high
- ✓ Special operating skills, costly set-ups, ring laps, special tools, *not* needed!

Prices Are Right:

- ✓ Model 100 . . . $775.00 complete
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Availability:

- ✓ 24 hours

May we have your order? Phone, wire (collect), or write today.

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. . . famous for their leadership, practical wisdom, and thrift for over 800 years.

You can be a canny Scotsman for your business, too. Investigate, consider, and buy your Size Control Centerless Lapping Machine.

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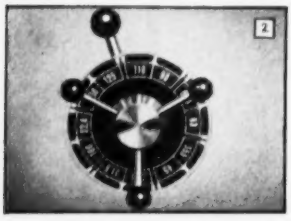
6 Advantages of the GOLIATH High Speed Lathe

- which have brought it so quickly into high demand



1 a - d **Quick chucking device** (German Patent)
Short-tapered spindle nose acc. to DIN 812 allows change of face plate, chuck, dog plate etc. in far less time than is required in the case of any other lathe. It will take you no longer than you need to read these lines . . . 6 to 10 seconds at most.

2 **Control of 12 spindle speeds trough only two levers**
You need but operate a single cross handle and the back gear lever, to control 12 spindle speeds, row I: 24 - 1000 r.p.m., or row II: 32 - 1400 r.p.m.

3 **Control of all threads and feeds through a single control block**
No tumbler yoke. All gears hardened and ground and with oil bath lubrication. Coarse thread 1 : 8. Multiple thread cutting device.

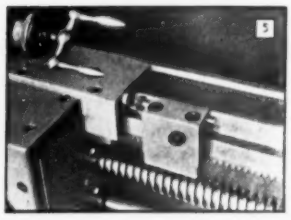
4 **Inverted V-way bed**
Novel bed construction. Chip slide to the rear. Bed reinforced through diagonal ribs. Full-length box type support. Protected V-ways.

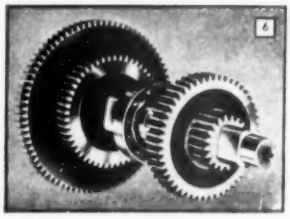
5 **Automatic apron release**
Release accuracy of .0004" guaranteed by patented drop-worm device. No recoiling of carriage.

6 **All sliding wheels and shafts with (K) Profile**
For more than 10 years we have been using the patented triangle (K) profile instead of hexagon spline shafts. This offers additional safety, as displacing of wheels is impossible while machine is running, and extends lifetime of lathe.

Specifications:

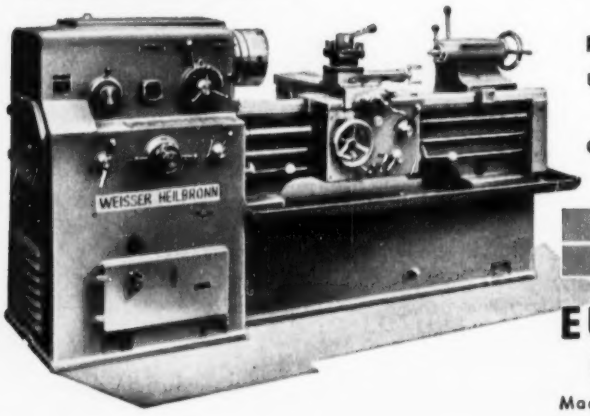
Max. swing over bed	18½" or 19¾"
Max. swing over cross slide	8¼" or 9⅞"
Distance between centers	30" / 40" / 60"
Motor	7,5 or 10 H.P.





Advise and service through our authorized expert agents.
Write for English prospectus No. 2132 to be sent to you without obligation.

Always Best! Always Weisser!



Representatives and Service:

USA: Guthery Machine Tool Corp., 130 West 42nd Street, New York 36, N. Y. Telephone: CHickering 4-2820.

Canada: Transocean Machine Company Inc., 267 Dunbar Avenue, Montreal 16, P.Q. Telephone: REgent 3-5373

WEISSER HEILBRONN

EUGEN WEISSER & CO. KG.
HEILBRONN / NECKAR (Germany)
Machine Tool Manufacturer – Salzstrasse 79/83 and 128/130

Here's Another Cimcool Booster!

Naturally Cimcool® gets a rousing cheer from housewives on washday. Because this radically new and different cutting fluid *doesn't soil clothes!*

And that's just *one* of the many reasons workers prefer Cimcool. It can't smoke. Can't burn. Doesn't soil hands. Contains no skin irritants. Leaves no dangerous slippery film on machine, work or floor. Virtually eliminates rancidity and foul odors. And, unlike old-fashioned cutting fluids, Cimcool is so effective that work and tools really stay cool to the touch.

You'll appreciate Cimcool, too, when you see how this chemical emulsion takes over 85% of all metal cutting operations. For a demonstration in one of your own machines, just write us and we'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Or, if you prefer, write for our free booklet, "CIMCOOL Defeats Heat." Address, Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

®Trade Mark Reg. U.S. Pat. Off.

CIMCOOL

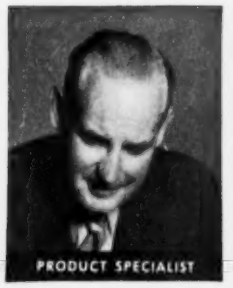
for 85% of all metal cutting jobs

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

TEAM SERVICE by U·S·Steel Supply is Fast!

WAREHOUSE SUPT.

INVENTORY ANALYST


PRODUCT SPECIALIST

SALESMAN

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Our telephone salesman is your "on-the-spot" assistant!

• When you want steel or supplies, or need information quickly about availabilities or prices, pick up your phone and call one of our telephone salesmen. He will turn your inquiry into immediate action and see that you get the steel or information you need without delay. Call a U. S. Steel Supply telephone salesman the next time you want *fast* action on steel.

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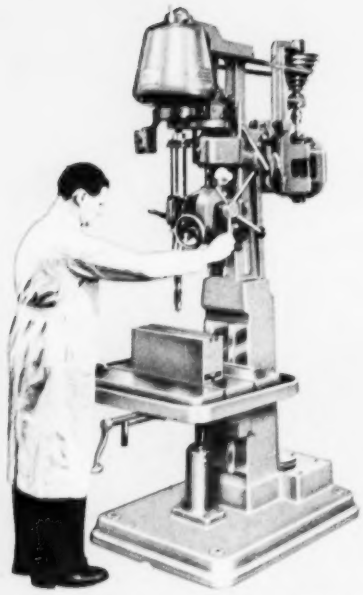
UNITED STATES STEEL

Cincinnati Lathes and Drilling Machines are so advanced that they deserve a new trade-mark — and here it is. You'll find it easy to remember, and well worth remembering. It stands for the company which designs, engineers, builds and backs up the most modern line of light and medium duty lathes (engine, toolroom and gap bed models) as well as drilling machines to cover practically all your drilling requirements. Write for catalogs and the name of your nearby CL dealer. He's always at your service.

best buys in their class!

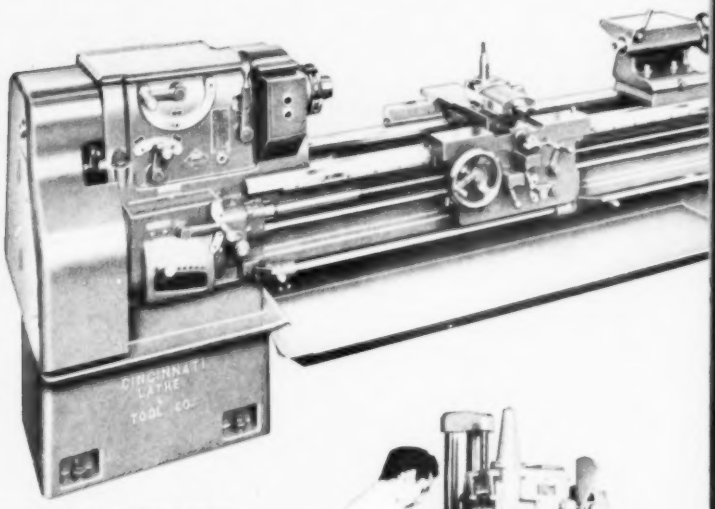
CINCINNATI LATHE & TOOL CO.

CINCINNATI 9, OHIO, U. S. A.

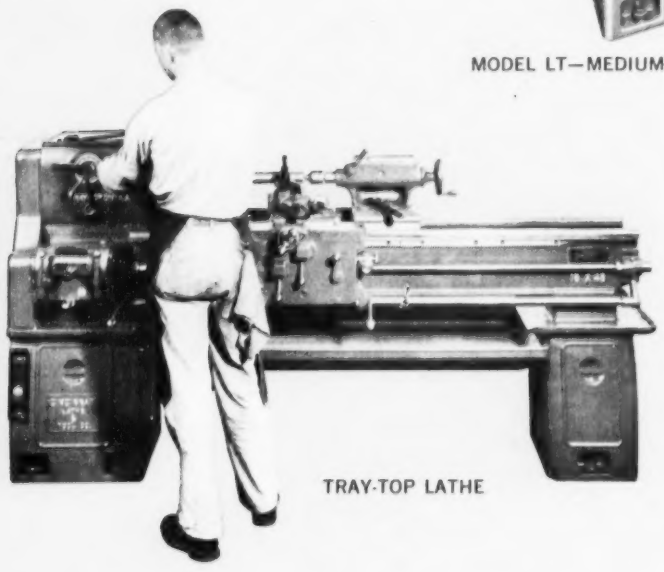


21" SLIDING HEAD BOX COLUMN FLOOR DRILL

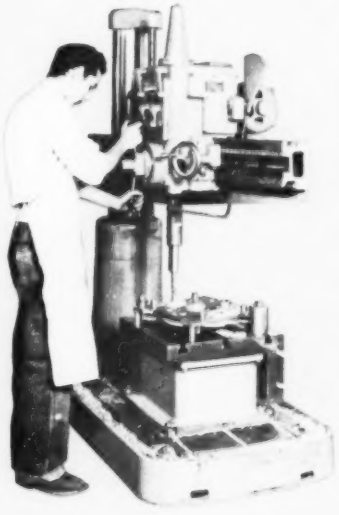
CINTIDRILLS: The complete, balanced line of drilling machines for all your drilling requirements for holes 1" OD and under. Complete line includes 3'-7" Radial, 21" Sliding Head (Box or Round Column), 21" Stationary Head, 16" 5000-10000 RPM, 16" 3000 RPM, 14" 3000 RPM for medium duty, 16" and 18" Royals for light duty. Bench, floor, and multi-spindle models. Nationally distributed.



MODEL LT—MEDIUM DUTY LATHE



TRAY-TOP LATHE



3' ARM, 7" COLUMN RADIAL DRILL

CINTILATHES: The complete, balanced line: Tray-Top for light duty (engine, tool room and gap bed models), Model LT for medium duty (engine and gap models). All geared headstocks, flame-hardened and ground bedways, and many other fine features at minimum investment.
Swing sizes: Tray-Top—10", 12½", 15", 18"; Model LT—16", 18", 20", 24".
Write for catalogs and name of your nearest dealer.

best buys in their class!

CINCINNATI LATHE & TOOL CO.

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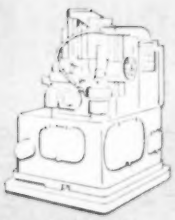
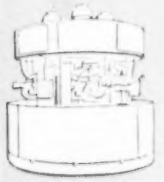
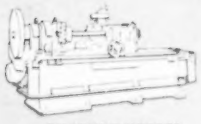


12-S HOBBER

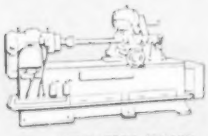


7-A ROTARY HOBBERS

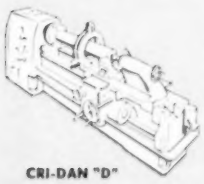


SH SPLINE HOBBER

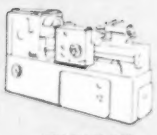
MODEL 40 THREAD MILLER



HT THREAD MILLER

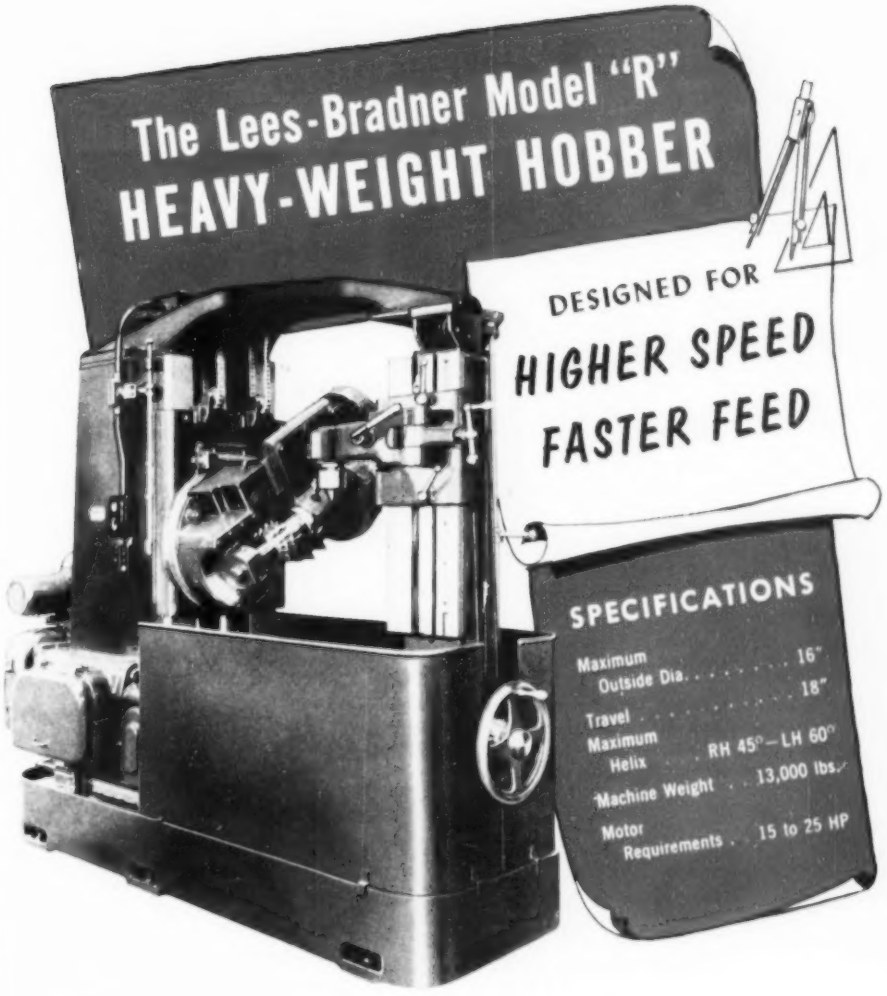


CRI-DAN "D"



CRI-DAN "B"

The Lees-Bradner Model "R" HEAVY-WEIGHT HOBBER


DESIGNED FOR
HIGHER SPEED
FASTER FEED
SPECIFICATIONS
Maximum Outside Dia. . . . . 16"
Travel . . . . . 18"
Maximum Helix . . . RH 45°—LH 60°
Machine Weight . . 13,000 lbs.
Motor Requirements . 15 to 25 HP

The true measure of the value of a machine tool is its productivity. And top day-in and day-out productivity can *only* be maintained if "down time" for maintenance is cut to a minimum.

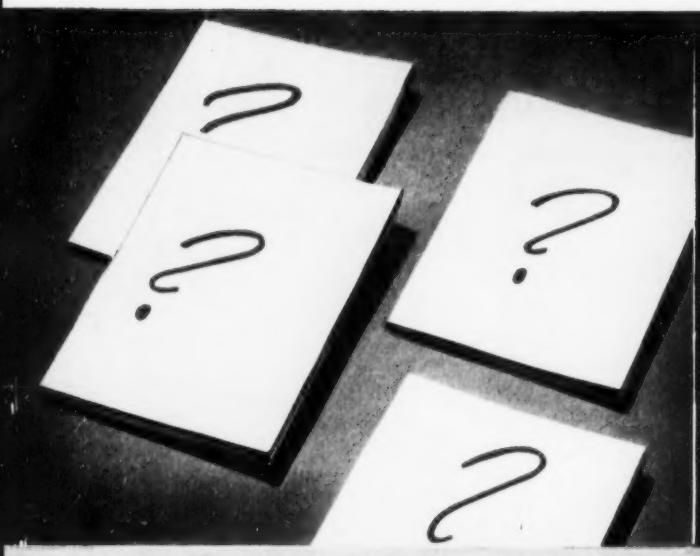
The Lees-Bradner Model "R" hobbing machine was designed and built to perform at higher speeds with faster feeds and at longer intervals of time than any other machine of its type. It has a rated capacity far in excess of that required by the work that will normally be run on it. This additional "built in" capacity guarantees an extra margin of performance on long production runs.

So, if you have a hobbing operation where high, uninterrupted production is a "must", by all means investigate the Lees-Bradner Model "R" hobber. Call in our representative in your area or get in touch with us direct.

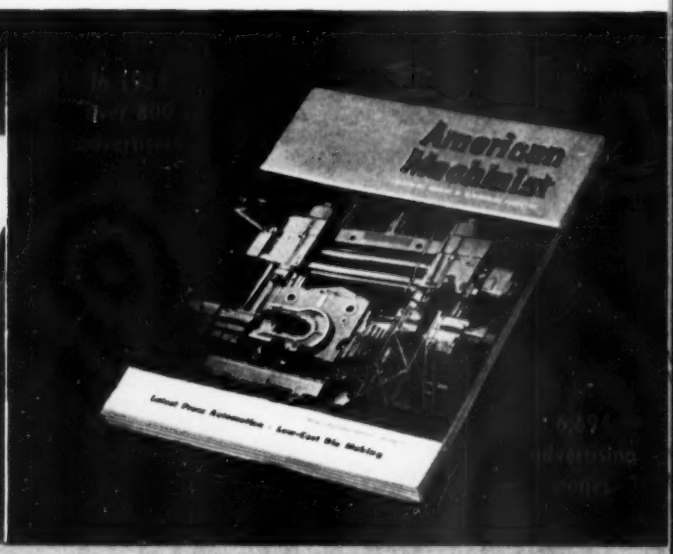
the LEES-BRADNER Company

CLEVELAND 11, OHIO, U.S.A.

Metalworking's NO. 1 medium puts

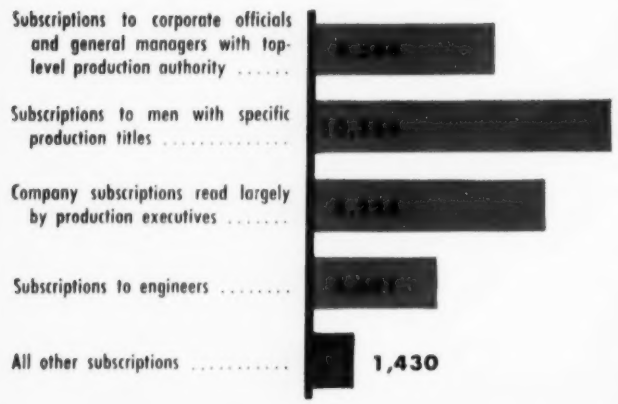


When you want to know *which* metalworking magazine can do the most efficient and productive job of building preference for your products, many sound reasons will lead you to a choice of *American Machinist* . . .



. . . for this magazine offers you the same exclusive values that attract over 800 successful advertisers to its pages, and last year drew the largest advertising investment that has ever been entrusted to any metalworking publication.

Top Penetration of Metalworking's Most Important Buying Group
Net-paid Circulation, November 17, 1952 Issue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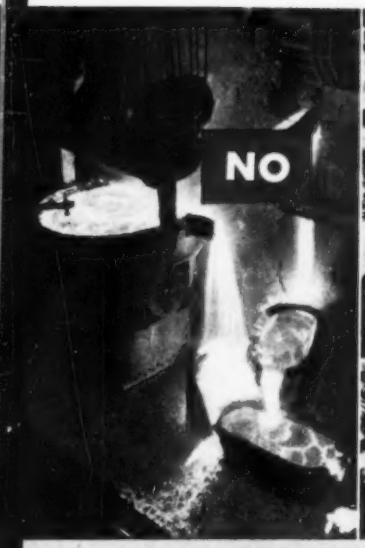
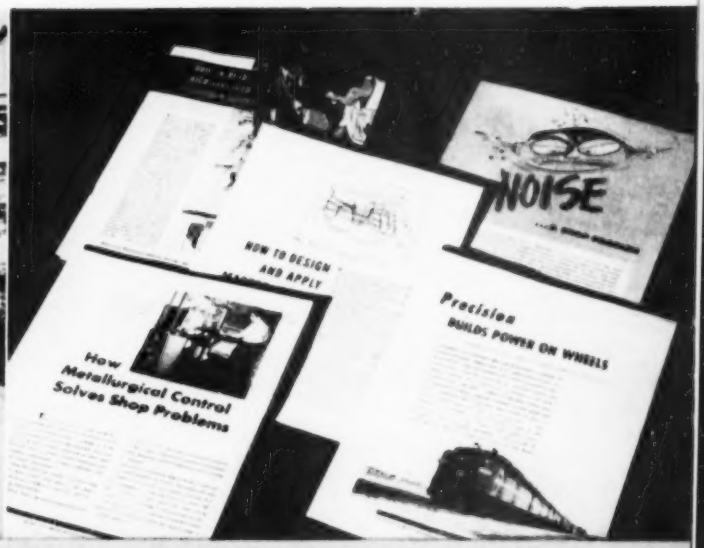
1,430

THIRD . . . while other metalworking magazines distribute thousands of free copies in an effort to provide coverage of Metalworking's important buying power, *American Machinist* delivers an all-paid, self-elected circulation of over 31,000 management-concentrated, production-responsible metalworking men. Thus, only *American Machinist*, among metalworking magazines, provides you with the proof of reader interest and responsiveness inherent in its all-paid, steadily growing circulation.

FOURTH . . . all of *American Machinist's* clear-cut, sales-building values are yours at a cost-per-thousand paid circulation far below that of any other magazine edited for the biggest of industrial markets.

exclusive values behind your advertising





FIRST . . . *American Machinist* is edited exclusively for Metalworking . . . and concentrates its circulation within this industry, so that a minimum of the advertising dollars you invest to sell Metal*working* are diverted into such entirely different industries and markets as Metal*producing*.

SECOND . . . *American Machinist* is edited specifically for Metalworking's most important buying group . . . *production engineers and executives*. With articles like those illustrated here, *American Machinist* delivers to busy executives more specifically helpful facts and ideas than are available to them in any other publication.

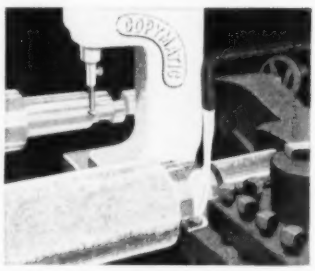
SO . . . when you seek increased sales in the $100-billion Metalworking Industry, and want to build preference for your products among this industry's most important buying group . . . production management . . . the facts will tell you why

This is the NO. 1 place to do business with America's biggest industry

THE McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION
McGRAW-HILL BUILDING, NEW YORK 36
PUBLISHED EVERY OTHER MONDAY
MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS AND THE ASSOCIATED BUSINESS PUBLICATIONS

ABP ABC

HOW HIGH IS UP?



Perhaps it's "the point toward which manufacturing costs are constantly climbing." What methods may be used to keep costs and prices from vanishing out of sight and reason?

Since time and manpower are the vital elements in costs, many progressive manufacturers are using Lodge & Shipley COPYMATIC Tracer Controlled Lathes to combat rising costs. Carefully verified reports show time savings as high as 87%, production increases up to 536%, savings of $14,000 in a year.

The COPYMATIC is so versatile even smaller shops find it a profitable producer . . . it offers instant changeover from tracer control to engine lathe. A COPYMATIC can save you money, too. Ask for case histories and Bulletin No. 675.

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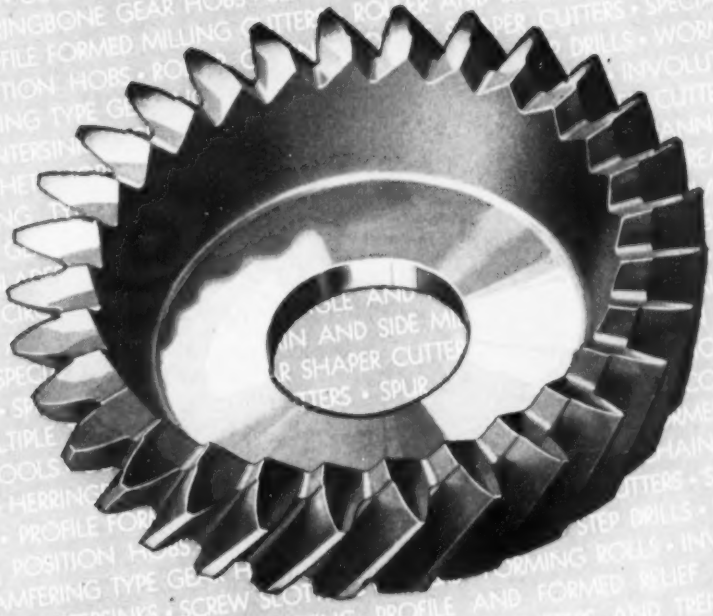
...DEPEND ON
National Tool Co.



● Years of successful experience in *special* tooling and related production problems are yours for the asking. When the job requires *special* cutting tools call in your National Tool Co. representative. He is backed by more than 46 years experience in the engineering and manufacture of *special* cutting tools. His assistance is yours, without obligation, whether you're interested in one tool or a complete tooling program.

Since 1905 engineers and manufacturers of high-quality special cutting tools for the metal-working industry

National Tools Cleveland

National
TOOL CO.
Cleveland 2, Ohio

GISHOLT'S *easier operation*

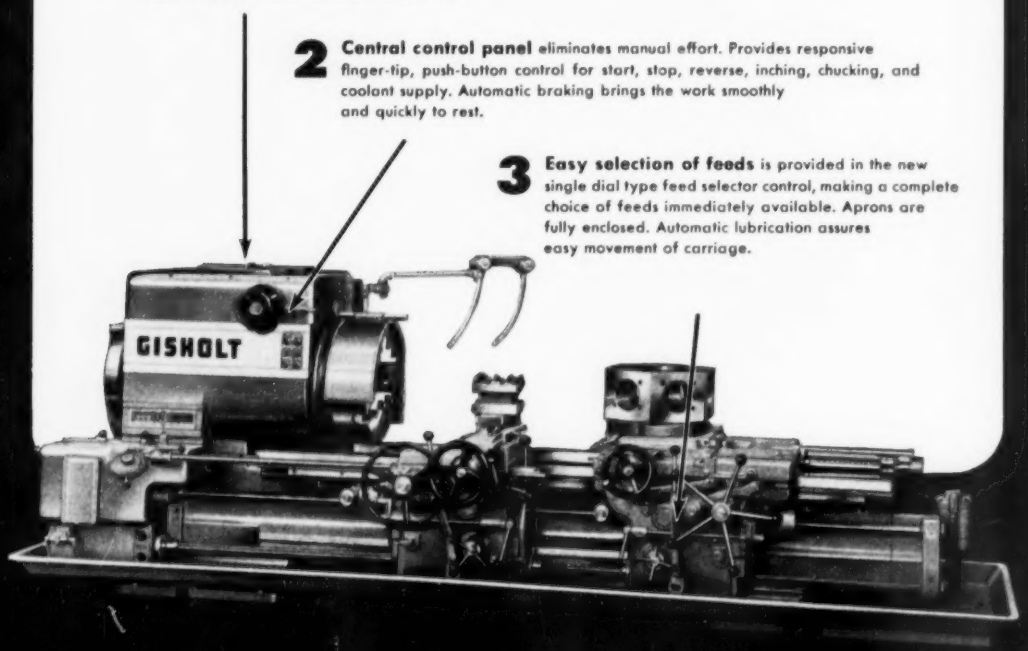
saves you time and money...

This 21,000 lb. machine requires no more operating effort than turret lathes ⅓ its weight. Despite its great power and rigidity for heavy-duty work, the new Gisholt 4-L is so fast and responsive, it can handle light work of both large and small diameters. With many machine functions entirely automatic, waste time is eliminated. Fatigue is reduced to a new minimum. Training time is shortened. Operator output is faster—more nearly constant throughout the day.

1 **Hydraulic Speed Selector** eliminates manual gear shifting. Spindle speed changes are made instantly by power without stopping the spindle or releasing the main drive clutch. Can be operated either direct or pre-set.

2 **Central control panel** eliminates manual effort. Provides responsive finger-tip, push-button control for start, stop, reverse, inching, chucking, and coolant supply. Automatic braking brings the work smoothly and quickly to rest.

3 **Easy selection of feeds** is provided in the new single dial type feed selector control, making a complete choice of feeds immediately available. Aprons are fully enclosed. Automatic lubrication assures easy movement of carriage.



The new Gisholt 4-L Saddle Type Turret Lathe provides 31⅜" swing over the ways, 27" swing over carriage wing, 9½" to 12½" spindle bores and 63" longitudinal working travel of turret carriage to accommodate an unusually wide range of work. Ask Gisholt engineers about this modern, easier operating Gisholt as applied to your specific machining requirements. New literature is available.

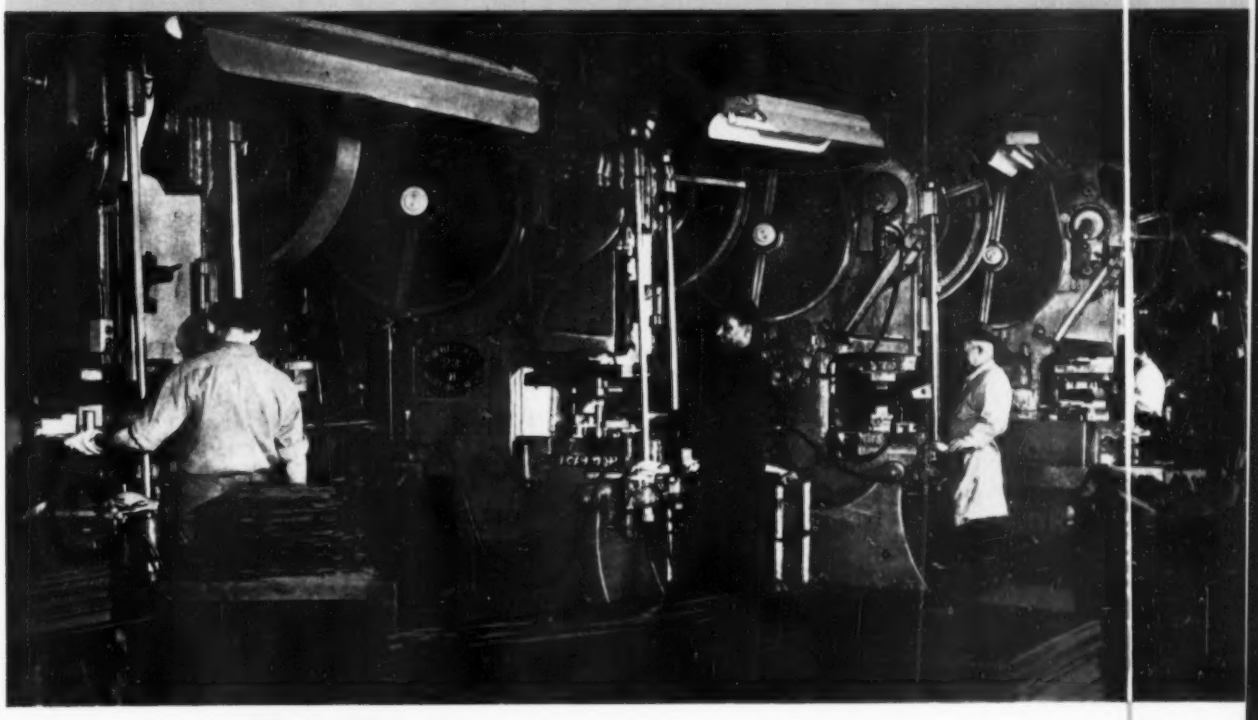
GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

At Art Steel Company, too,

BLISS *Presses Predominate*



97% are Bliss*-Built*

Now, Art Steel Company, one of the leading manufacturers of steel office equipment — *Steelmaster* — credits Bliss with an important role in its progress. For Art Steel has looked to Bliss since 1923 for engineering counsel and the right press for each operation. Seventy-three Bliss presses making up 97% of Art Steel's press equipment attest to the fact that Bliss has justified this confidence.

Asked *why the continued preference for Bliss presses,* Art Steel officials sum it up in one word — "*dependability*".

And that's why hundreds of sheet metal plants throughout this country and abroad specify Bliss presses more than any others. Whether your requirements involve mechanical or hydraulic presses . . . high speed or normal speed . . . straight side or gap frame . . . it pays to call for a Bliss engineer. He can show you why Bliss belongs in *your* press room, too.

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PROFILE-TRACING
LATHE ATTACHMENT

MULTIPLE O.D.
STEP TURNINGS

Turning 90° shoulders in the direction of the feed, or blending a shoulder with a radius, is possible on either I.D. or O.D. turning.

MAKES
precision duplicating
PRACTICAL and PROFITABLE
in any machine shop . . .

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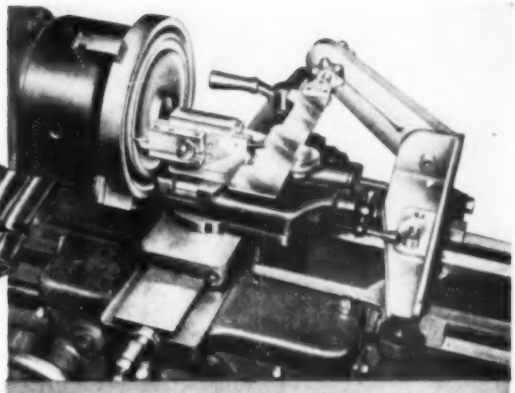

Use it for PROFITS—
Use it for CONVENIENCE

Now any machine shop that has an engine lathe can turn out precision duplicating at low cost. No longer need orders for identical duplicates be farmed out or refused.

This completely *new* profile tracing attachment is rugged, compact and thoroughly shop-proved. Its extremely simple design makes it foolproof and trouble-free. Its versatility adapts it to many different applications and it will satisfactorily perform most of the operations of high-cost, complicated duplicating equipment.

INSTALLED IN FIVE MINUTES

Installation or removal requires only a few minutes. No alterations to the lathe are necessary. Once set up, a lathe equipped with PRO-TRACER can be operated by semi-skilled labor. One operator can run a battery of them.

- **PRECISION BUILT** — *tolerances as close as .0005 have been held.*
- **INSTANT TOOL RETRACTION** — *pre-loaded ball bearings also eliminate play and back lash.*
- **WORK SIZE** — *limited only by length of lathe.*
- **TEMPLATES** — *easily and inexpensively made from standard ground stock 1/8"x2".*
- **SHORT OR LONG RUNS** — *rugged enough for three-shift production. Ideal for runs too short for long-run equipment.*

Write for fully descriptive folder.

only $375 complete

IN STURDY CARRY CASE FOR COMPACT STORAGE

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Lehigh
FOUNDRIES, INC.
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Manufacturers of a complete line of
AIR VALVES • CYLINDERS • HOISTS
Precision Castings • Automatic Vending Machines
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Profile Tracing Lathe Attachments

QUICKLY SET UP FOR

MULTIPLE FACINGS

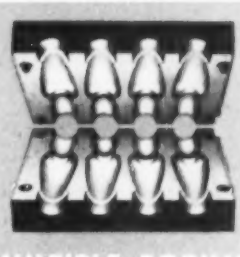
By turning Lehigh PRO-TRACER at right angles to spindle, it can be used for profile facing.

MULTIPLE O.D. TURNINGS

The Lehigh PRO-TRACER can be used for O.D. turning including tapers. It will make an .031 minimum radius and will turn an unlimited maximum radius.

MULTIPLE SHOULDER THREADINGS

Internal or external threadings, straight or tapered, can be made with Lehigh PRO-TRACER. Because of quick-retracting of cutting tool, thread can be cut close to a shoulder without danger of breaking tools.

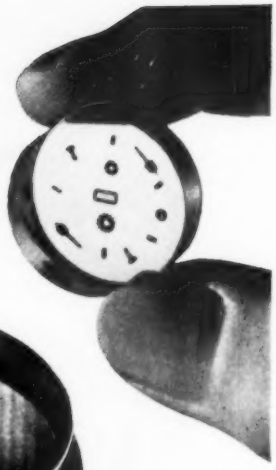


MULTIPLE BORINGS

Boring and I.D. contours can be turned with Lehigh PRO-TRACER by same method as conventional O.D. turning. A 90° step can be cut in the direction of the feed.

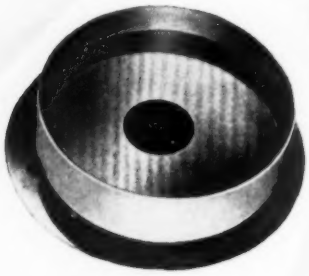
Tiny?

Yes! The No. 11 Blanchard Surface Grinder grinds these ladies' watch gears, pinions and ruby bearings flat and parallel, and to a dimension tolerance of .0002".



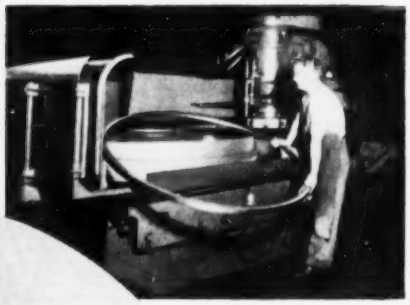
Smooth?

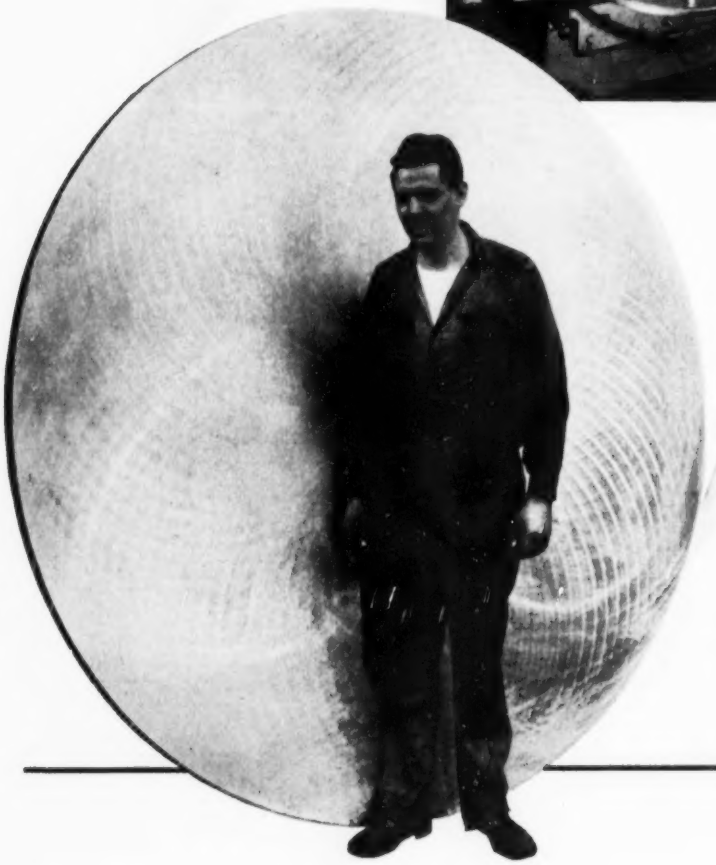
Of course! The Blanchard No. 11 finished this refrigerator plate, seen through an optical flat, to 3 micro inches and flat within 1 light band (.0000118").



Accurate?

Sure . . . and easy, too! This Blanchard grinds 84" forged steel rings flat within .0002", parallel to .0002", dimension tolerance of ±.0005", and with surface finish of 4 micro inches.





Tremendous?

Yes . . . but fast! This 88" diameter cast-iron plate was ground on a No. 42-72-84 Blanchard in 3½ hrs., floor to floor. ¼" of stock—1520 cu. in.—380 lbs. was removed.

If you produce flat surfaces, your best bet is Blanchard Grinders—with Blanchard Wheels!

PUT IT ON THE BLANCHARD

Send for your free copies of "Work Done on the Blanchard", fourth edition, and "Art of Blanchard Surface Grinding".

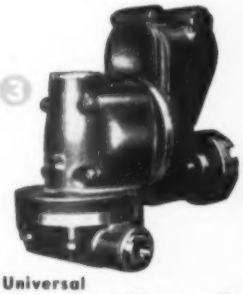
THE BLANCHARD MACHINE CO.
64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

Milling Machine Attachments that STEP UP PRODUCTION

You can easily convert your general duty Milling Machine to a special purpose Miller by utilizing Kempsmith Standard Attachments. They can handle a great variety of milling operations with speed and precision, thereby enabling you to step up your plant production. Attachments 1 to 3, shown below, can be mounted on Kempsmith Millers. Numbers 4 to 7, inclusive, can be mounted on ANY make of milling machine. The same high degree of rigidity and precision characteristic of Kempsmith Milling Machines for more than 60 years is embodied in these sturdy standard attachments. Thousands are serving industry every day, performing the most delicate and accurate operations, or handling difficult production milling jobs. So plan now on broadening the scope of YOUR milling machines by applying Kempsmith Attachments. Write for bulletins.

Vertical Head
Converts horizontal to vertical machine, retaining identical spindle characteristics. (Bulletin No. 105)

Slotter
Keyseating, broaching, general slotting, tool and die making, etc. (Bulletin No. 107)

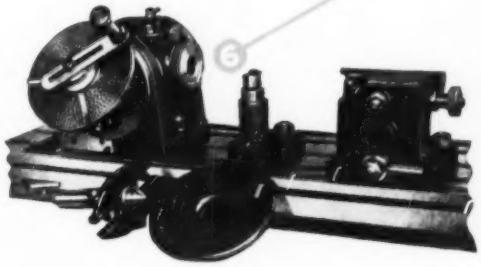


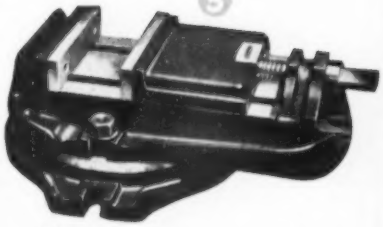
Hi-Speed Universal
High speed angular milling in all planes. (Bulletin No. 113)

Arbors and Accessories
A full range for standardized spindles carried in stock. (Bulletin No. 116)

Circular Table
Milling circles or cams, gear cutting, high-speed continuous milling, etc. (Bulletin No. 106)

Dividing Head
Precision indexing. Spiral cutting mechanism and chuck also available. (Bulletin No. 119)





Vises
Standard and Heavy-Duty, plain and swivel types. Adaptable to special jaws to save fixtures. (Bulletin 117)

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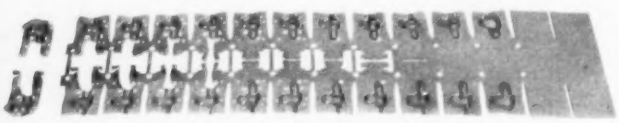
In the small area occupied by a compact Henry & Wright Dieing Machine you have a production tool equal in capacity to five or ten conventional presses. Progressive stamping on a Henry & Wright really pays off, because this press is specifically designed for this type of work.

Angular thrust is not transmitted to the upper crosshead. Low center of gravity holds vibration to an absolute minimum. Long ways, plus four post guidance and a pulling instead of pushing stroke, serve to strait-jacket punch travel. Accurate punching produces high quality work and a lot more of it between die grinds. Much less metal is removed when dies are ground.

Get the whole story about the Henry & Wright Dieing Machine—the economies you achieve in die life, inspection, toting, operators. Retrench by modernizing with Henry & Wright.

Refrigerator part produced at speed of 65 strokes per minute of .060" cold rolled steel on 100-ton Dieing Machine.

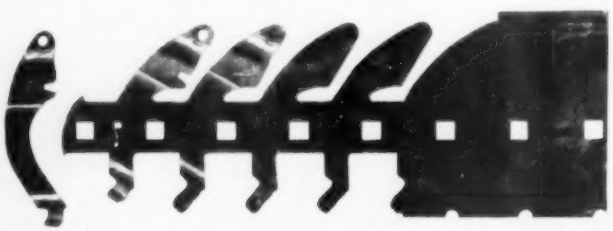
Hemispherical shell 2" deep produced at speed of 60 strokes per minute.



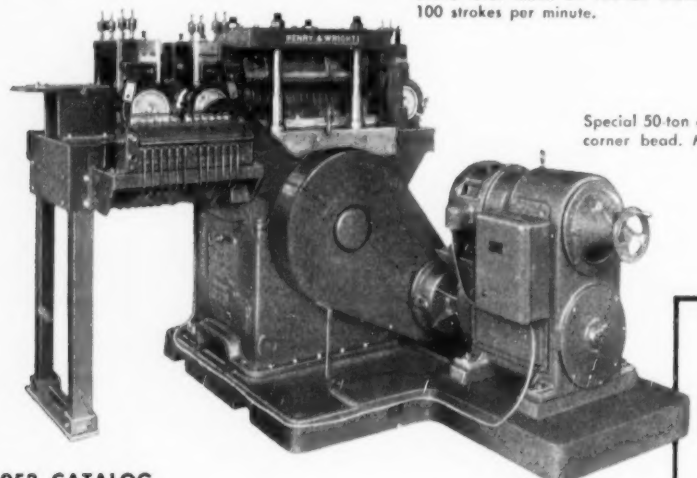
Paired sections of housing produced of .065" hot rolled steel at 60 pairs per minute.

Radiator fin of copper made three at a time at speed of 85 strokes per minute.

Radio part produced one per stroke at speed of 300 strokes per minute.



Brake lever made on 150-ton Dieing Machine operating at speeds in excess of 100 strokes per minute.



Special 50-ton dieing machine for production of expanded corner bead. Machine operates 620 strokes per minute.

1953 CATALOG

Write for your copy on company letterhead to Henry & Wright, Division of Emhart Mfg. Co., 481 Windsor St., Hartford, Conn.

Only the best is good enough

HENRY & WRIGHT

DIVISION OF EMHART MFG. CO.

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ALL SLIDEWAYS ABOVE GRINDING WHEEL

protected from abrasive dust and grit . . . LONGER LIFE.

NO GRAVITATIONAL PULL

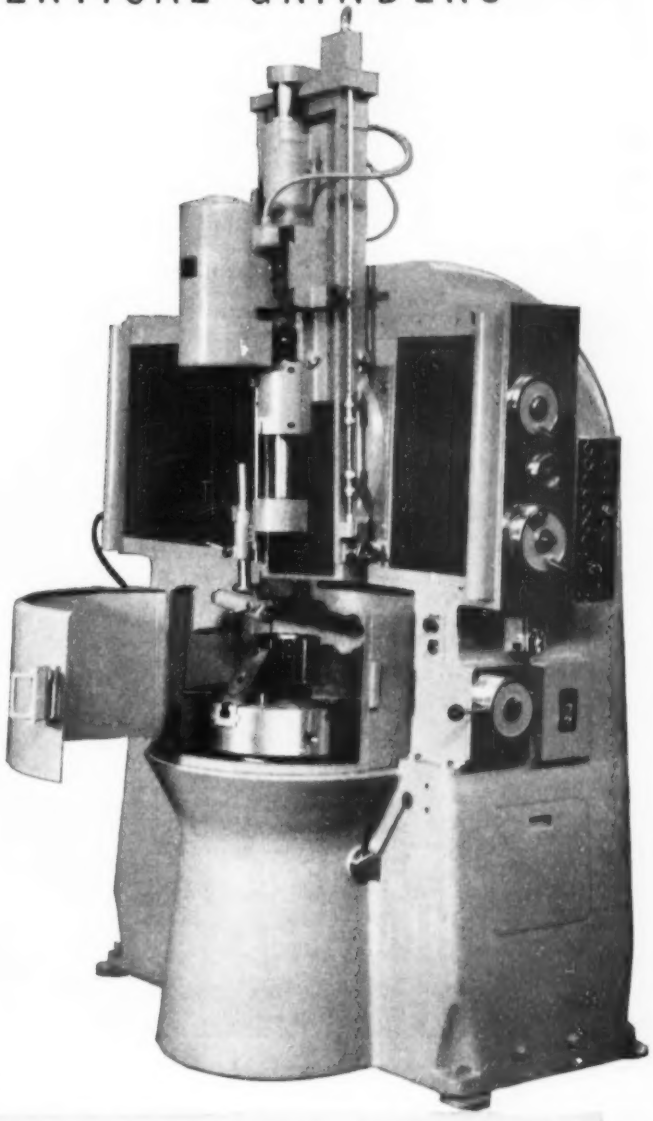
to throw work out of line. Work sets solidly on vertical spindle . . . GREATER ACCURACY.

EASE OF OPERATION

All controls conveniently located at normal height; greater work visibility; easier loading . . . HIGHER PRODUCTION.

PLUS the added advantage of GREATER VERSATILITY

Grind combinations of O.D., I.D., faces, tapers, shoulders or steps with one set-up. Hold extremely close related tolerances.



Springfield Vertical Grinders are thoroughly proved by 14 years of time-saving, cost-saving precision production. Various capacities to 42" swing x 24" hole depth.

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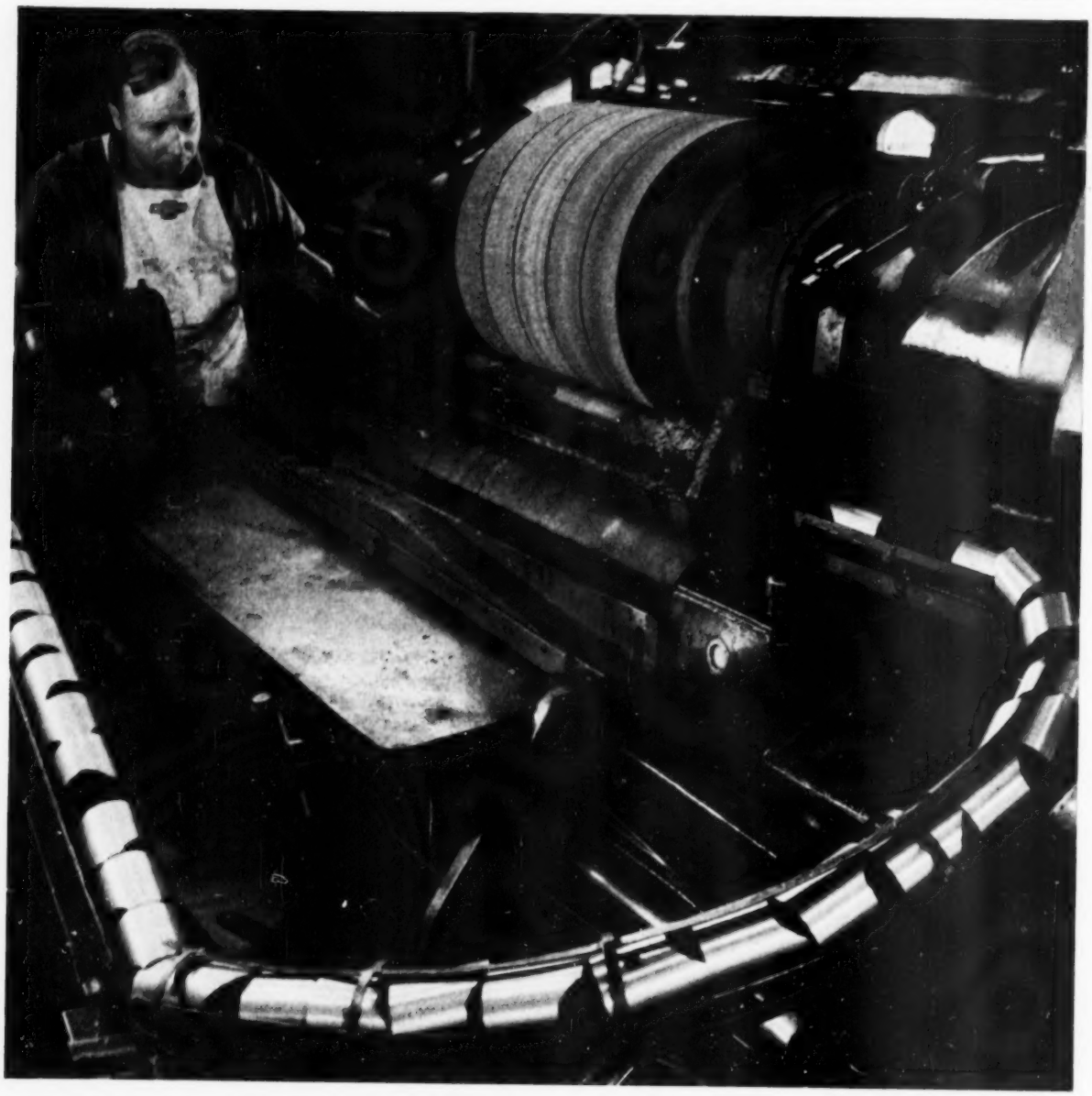
How can a *'phone call* improve your



CARBO
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CENTERLESS GRINDING?

Find out by calling your CARBORUNDUM *distributor or salesman. Ask him to prove to your satisfaction that* CARBORUNDUM'S *grinding and regulating wheels* **can** *improve production and performance...*

He'll put your grinder to the test...using your operator and the materials you are grinding or lapping. And there are mighty good reasons for his confidence that he *can* show you how to do a better job—as he has done for hundreds of other plants. The wheels he recommends are all *proven-on-the-job.* They're engineered to give you the exact combination of the best abrasive grains and bonds, tested for their ability to do specific grinding jobs on specific materials.

Take armature grinding, for example. CARBORUNDUM engineers have developed a radically different regulating wheel with a specially constructed resilient rubber core. This resilient regulating wheel exerts a light but even pressure on the work. Result? Less grinding pressure, which is the cause of faulty finish on such parts as armatures. Rejects are reduced or eliminated. This is just one example of CARBORUNDUM'S leadership in the field of centerless grinding.

Make the Telephone Call Today!

Call your CARBORUNDUM distributor or salesman—he's listed in the yellow pages under "Abrasives" or "Grinding Wheels." Let him show you how CARBORUNDUM'S grinding and regulating wheels have earned their reputation as "the standard of the industry." Or write The Carborundum Company, Dept. AM 81-315, Niagara Falls, New York.

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...the ONLY source for EVERY abrasive product you need

Westinghouse

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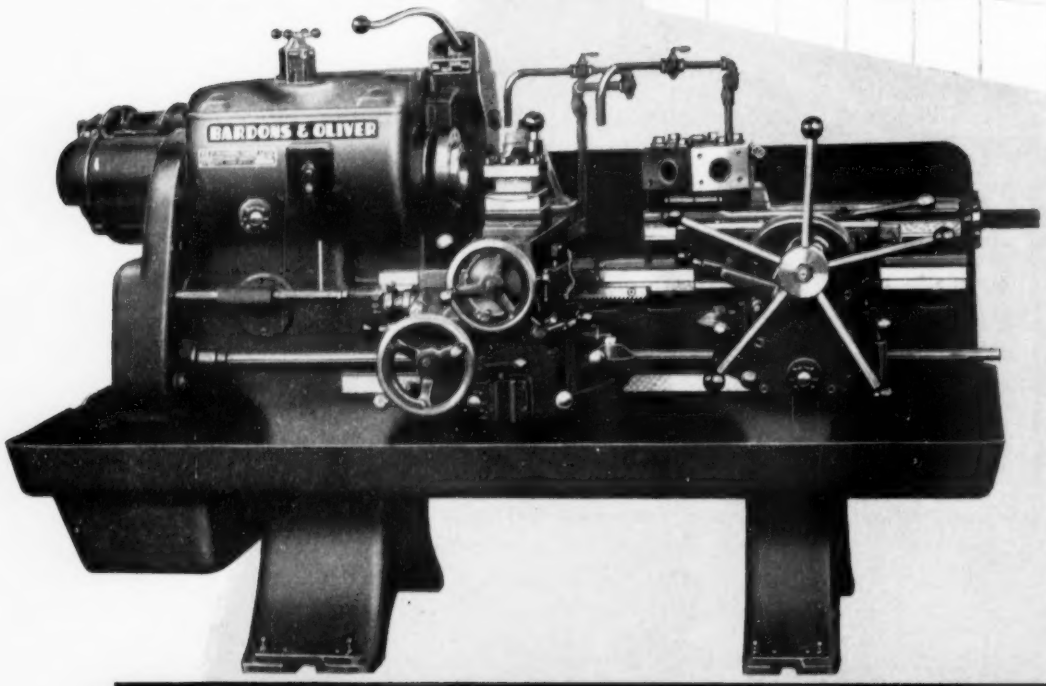

with BARDONS & OLIVER turret lathe

After Westinghouse installed the new Bardons & Oliver No. 5 Turret Lathe their production on Corox Heater Head Flanges increased over 100%.

The performance story at Westinghouse is just one of many. Bardons & Oliver Turret Lathes have served industry for over 60 years with continuing improvements to keep ahead of modern industry. Your inquiry for literature or additional information is always welcome.

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SCENE 96:
"Accuracy Counts!"
...an actual scene from the GTD-Greenfield sound film "FACTS ABOUT TAPS AND TAPPING"
VOICE: "Good gaging technique is essential to insure interchangeability of threaded parts ...Here we see a plug gage used to make sure that threads are held within the GO and NOT GO limits set by the designer... It pays to use guaranteed accurate gages... Remember, a poor gage that rejects good products is an expensive tool."
GREENFIELD
TAP AND DIE CORPORATION
GREENFIELD, MASSACHUSETTS
This 26-minute full-color motion picture "FACTS ABOUT TAPS AND TAPPING" is now available for group showing through your local GTD-Greenfield distributor.

"YES...WE'VE GOT THOSE TAPS IN STOCK"

That's your INDUSTRIAL DISTRIBUTOR talking. Many a time, no doubt, you've heaved a sigh of relief when you've heard the welcome words, "Sure we've got 'em", or when you need service, "We'll send Jack right over".

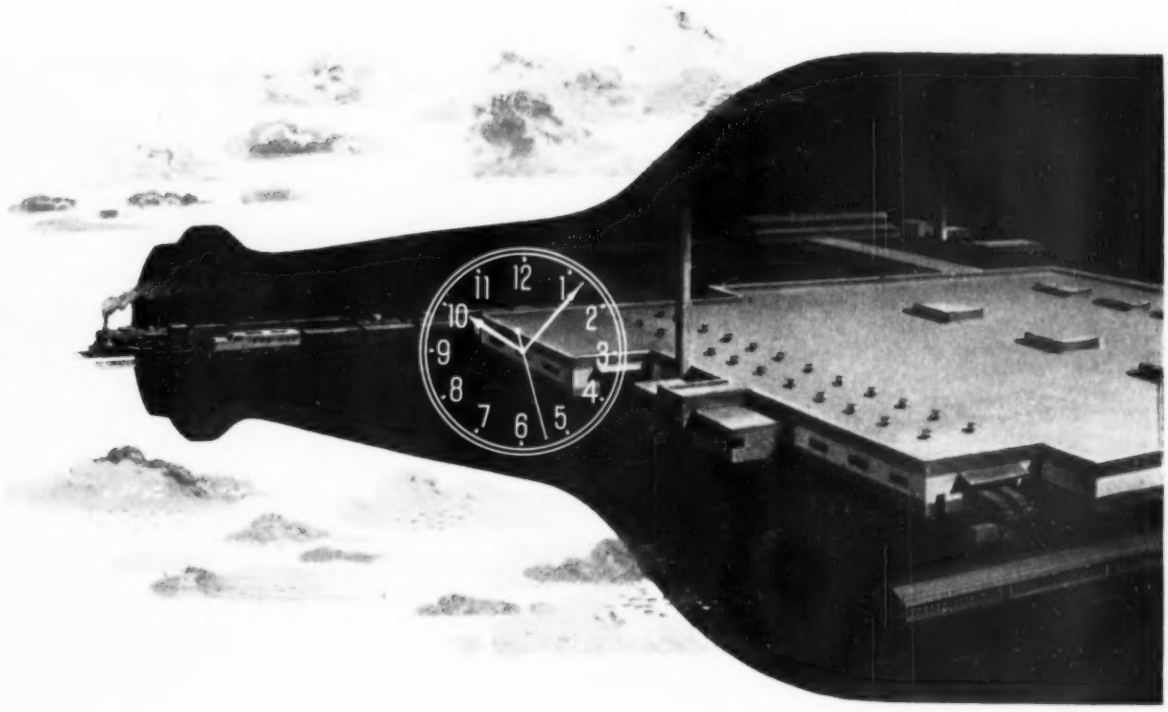
And your GTD-GREENFIELD Distributor also has direct friendly contact at the factory with men he knows well, regarding non-stocked items or special tools.

Yes, it will pay you to get better acquainted with your GTD-GREENFIELD Distributor. Stop shopping around . . . stop buying the hard way.

GREENFIELD TAP AND DIE CORPORATION

GREENFIELD, MASS.

Every Plant has a Built-In Bottleneck



You built the finest plant engineering brains could conceive. You provided up-to-the-minute tooling—polished up distribution and sales. But all that was only a good start.

The clock keeps on ticking.

And people keep on getting bright ideas.

Suppose you tooled up as of not too long ago with the most productive lathes of the times. And then comes along a lathe like our Air-Gage Tracer Controlled Mona-Matic. This high speed, fully automatic cycle machine consistently cuts costs 30-50%, and earns users' comments like these: Plant A, "Reduced machining time from 81½ minutes to 11¼ minutes"; Plant B, "Reduced operations from 12 to 2"; Plant C, "Not operating full time, machine paid for itself in one year."

Someone's going to use it to kick the stuffing out of costs.

And there's your built-in bottleneck at work with a vengeance. You've got to do one of two things. You can figure that what with taxes, and your machine tool inventory, only partially depreciated, you'll wait.

Or, instead of fighting a losing battle, you can size up your earnings and reserves—face the fact that it is machines, not dollars, that keep a plant competitively productive—burst your bottleneck wide open—and build for the greatest years your company can hope to have.

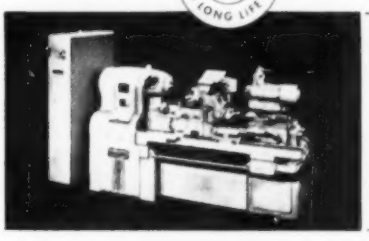
If you figure that way, you can count on Monarch lathes and Monarch engineering to back you all the way. . . . . *The Monarch Machine Tool Company, Sidney, Ohio.*

FOR A GOOD TURN FASTER . . . TURN TO MONARCH

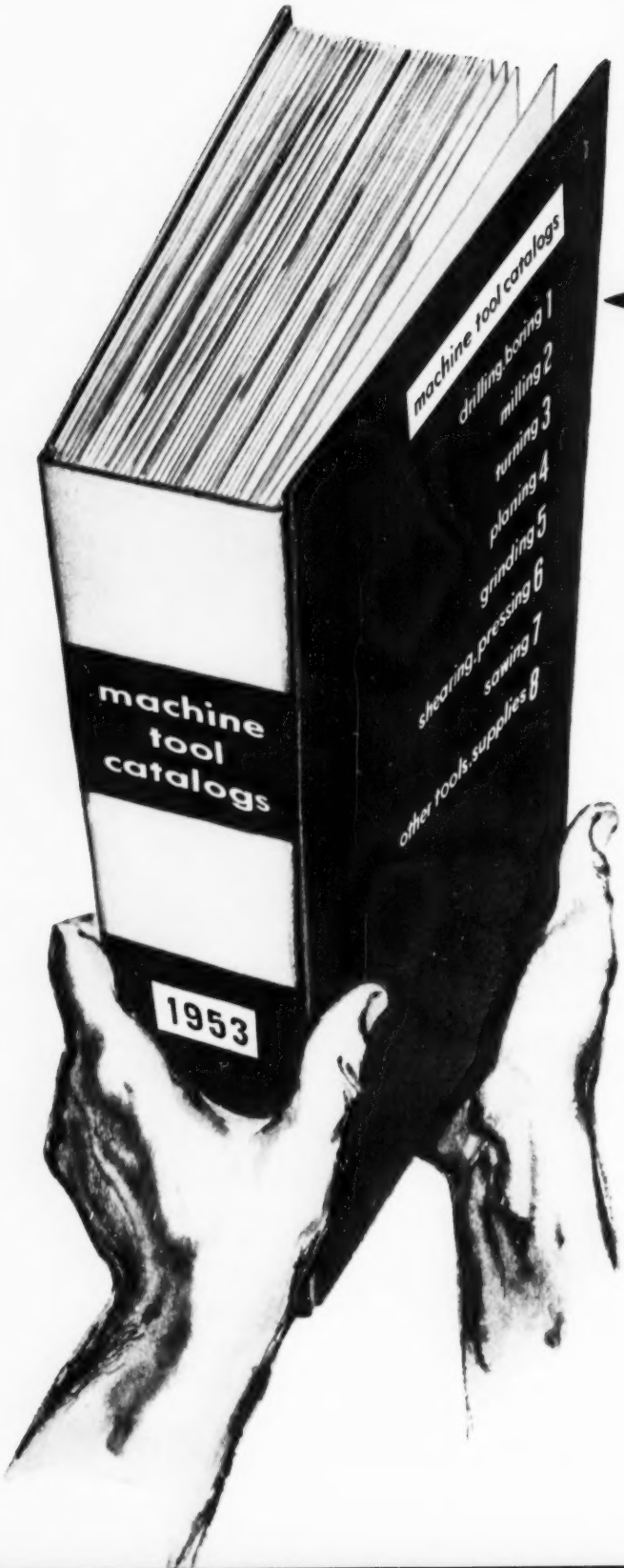
Monarch

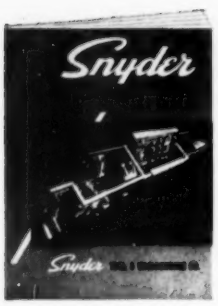
ACCURACY • ECONOMY • LONG LIFE

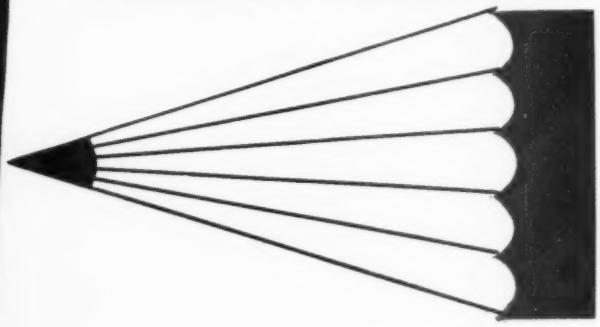
TURNING MACHINES

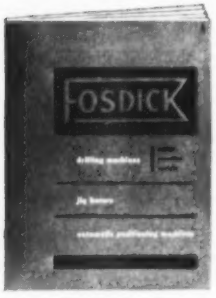


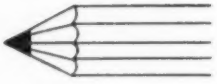
The Monarch Mona-Matic—high speed production turning at its finest. Monarch has built fine lathes for production line and toolroom since 1909—has pioneered the use of tracer controls since 1930.





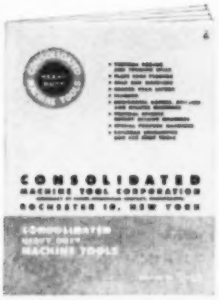






"...a great time-saver."

Sweet's

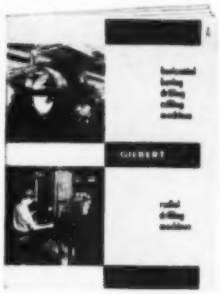


looking for drilling and boring machines?

also:

The following catalogs, in other sections of your Machine Tool Catalogs, contain information on drilling and boring machinery:

	SECTION
Brown & Sharpe Mfg. Co.	2
Bullard Co.	3
Cincinnati Lathe & Tool Co.	3
Famco Machine Co.	6
Greenlee Bros. & Co.	3
Hall Planetary Co.	2
Heald Machine Co.	5
Kearney & Trecker Corp.	2
Knight, W. B., Machinery Co.	2
Levin, Louis, & Son, Inc.	3
Motch & Merryweather Machinery Co.	2
New Britain Machine Co., (New Britain-Gridley Machine Div.)	3
Plan-O-Mill Corp.	2
Sundstrand Machine Tool Co	2
Taft-Peirce Mfg. Co.	5
Wales-Strippit Corp.	6



reach for Machine Tool Catalogs

These manufacturers' catalogs are instantly available in Section 1 of your Machine Tool Catalogs. They contain comprehensive information on drilling and boring machines and accessories.

The other sections of the File contain additional catalogs covering a wide range of machine tools and accessories.

This collection of 81 manufacturers' catalogs is grouped in sections by types of equipment, so that you can more readily compare one machine tool with another. Indexes of manufacturers, products and trade names lead you quickly to the catalogs you are looking for.

Sweet's is working constantly to get more manufacturers to send you their catalogs in this easy-to-use form. If you fail to find what you want, please tell us.

Catalog Service

DIVISION OF
F. W. DODGE CORPORATION
119 WEST 40TH STREET
NEW YORK 18, N. Y.

In hydraulic pumps

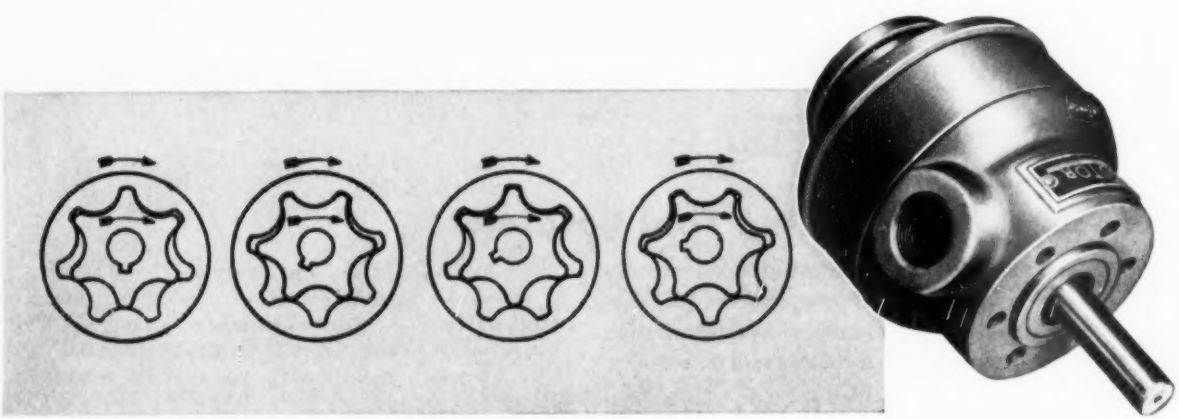
GEROTOR

is more than a name . . .

it's the principle of the thing!

The unique Gerotor principle operates with high volumetric and mechanical efficiency. Both gear-shaped Gerotor elements revolve in the same direction at low relative speed, resulting in less wear, longer life. Continuous fluid-tight engagement means less slippage, more uniform flow. See relative advance of teeth and spaces below.

Gerotor hydraulic pumps are engineered for pressures up to 1000 p.s.i. continuous duty; in some sizes, up to 1200 p.s.i. continuous and 1500 intermittent. Deliveries range from .4 g.p.m. at 1800 r.p.m. to 40 g.p.m. at 1200 r.p.m. Plain, base or flange mounting. Write for pump catalog. GEROTOR MAY CORP., P. O. Box 86, Baltimore 3, Md.



GEROTOR hydraulic pumps & motors

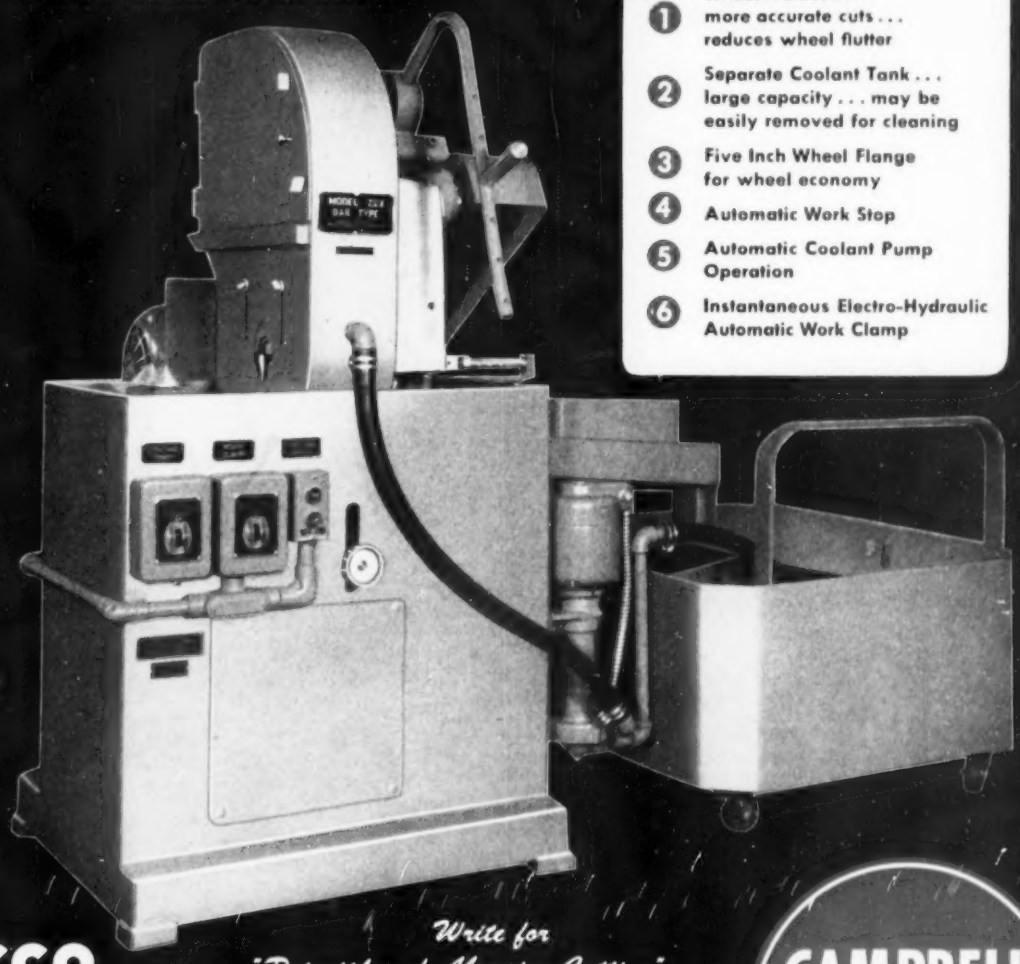
ACCO products

CAMPBELL Abrasive Cutters

New... Low Cost

No. 223 Wet Abrasive Cutting Machine

Fast, clean, close tolerance cuts of hardest alloys and all other metals. Won't work-harden material.



FEATURES

1. Wheel Guides for more accurate cuts... reduces wheel flutter
2. Separate Coolant Tank... large capacity... may be easily removed for cleaning
3. Five Inch Wheel Flange for wheel economy
4. Automatic Work Stop
5. Automatic Coolant Pump Operation
6. Instantaneous Electro-Hydraulic Automatic Work Clamp

Write for "Principles of Abrasive Cutting"

ACCO

TRADE MARK

CAMPBELL MACHINE DIVISION
AMERICAN CHAIN & CABLE

923 Connecticut Ave., Bridgeport 2, Conn.

CAMPBELL
Abrasive Cutters and Nibblers

Announcing NEW PINES

Patents Pending

SPECIFICATIONS

CAPACITY

Hydraulic Power — 20 tons.

Tube Size Range — ½" through 2" O.D. Maximum 2" x .083 steel tubing.

Bending Clearance — 2" tube with 5" center-line radius to 180°.

CUSHIONS

Twin double-acting cylinders offset mounted on sides of press, direct connected to heavy, needle bearing crank arms of wing die holders. Three anchor positions compensate for various settings.

DIE HOLDERS

Forward-mounted, equally controlled wing-type with single screw adjustment and die recesses.

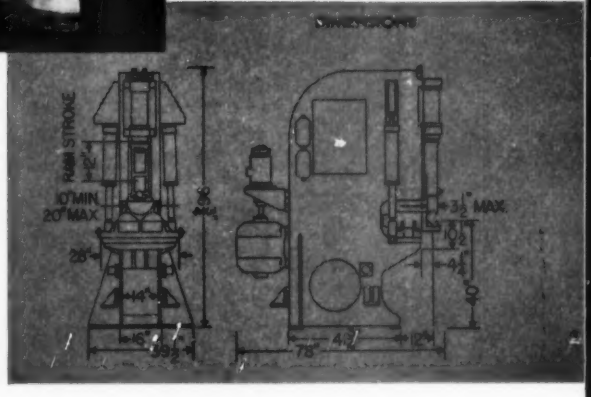
BASE

Welded HR steel frame work, stress relieved. Incorporates oil reservoir, pump, motor, and valve-mounting units.

ELECTRICAL

20 hp, 1200 rpm motor powers 2000 psi Vickers pump. 220-440 volt, 3-phase, 60-cylce. Control circuits on 110 volt through transformer.

New Pines 20-Ton Vertical Hydraulic Tube and Pipe Bending Press showing side-mounted twin oil coolers, panel-mounted hydraulic valves, side offset-mounted cushion, and 10-station automatic angle-of-bend selector turret. Note how design eliminating under die cushion mounting provides extra working clearance. On this setup, adjustable bars at left are used for positioning workpiece for various planes of bends.



PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery

671 WALNUT • AURORA, ILLINOIS

PRODUCTION BENDING • DEBURRING • CHAMFERING MACHINERY

20-Ton Tube and Pipe BENDING PRESS

DESIGNED WITH EXTRA WORKING CLEARANCE..... SPEEDS HANDLING BROAD RANGE OF MULTIPLE BENDS IN ONE SETUP

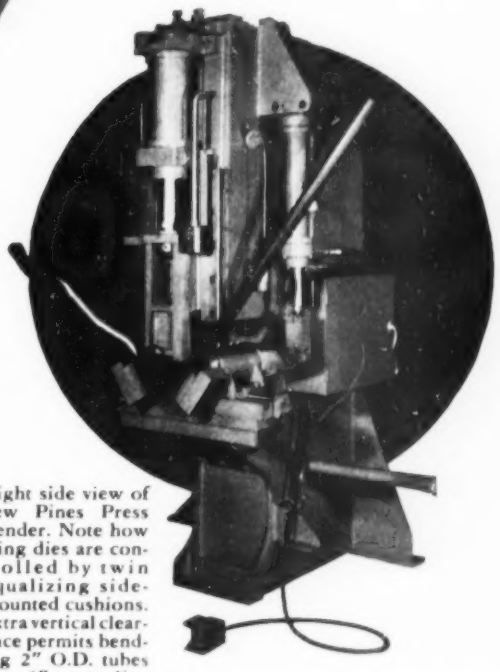
You'll find in the new Pines 20-Ton Hydraulic Press Bender a world of new production features, including those you have been wanting for a long time, that will help you substantially increase output and reduce production costs. You'll find the overall design affords greater working area on both sides and in front of the press and permits handling a much broader range of multiple bends in a single setup.

You'll like the new 10-station automatic angle-of-bend selector that eliminates cycling through idle stations, and the twin double-acting cushion cylinders on each side of the press that positively maintain a constant equalized pressure and help produce smoother, better bends without excessive flattening or distortion. Easy operating and setup features are included that save time and reduce operator fatigue.

These, and the many other outstanding Pines features listed below, will help you step up efficiency as much as 50% in handling, for example, automotive exhaust and tail pipes requiring a variety of bends in different planes, as well as the hundreds of other jobs adaptable to press benders.

OUTSTANDING FEATURES

- **Twin Equalizing Side-Mounted Cushions** — eliminate base obstructions, provide greater working clearance, maintain constant torque, reduce flattening and distortion.
- **Faster Cycling** — 10-station angle-of-bend selector indexes and resets automatically to starting position, eliminates cycling through idle stations, increases output.
- **Greater Work Handling Capacity** — extra clearance reduces number of setups on multiple bending, permits broader use of uniform radii, cuts tooling and production costs.
- **Interchangeable Pick-Off Turret** — for angle-of-bend control. Permits storing and remounting for repetitive jobs, reduces setup time, insures accurate duplication on repeat work.
- **Adjustable Ram Speed Control** — assures efficient operation, simplifies setups. Ram can be lowered slowly or stopped at any point.
- **Built-In Oil Coolers** — maintain uniform oil viscosity, assures uniform results on production runs.
- **Single-Screw Wing Die Adjustment** — eliminates problem of equalizing die settings. Adjusts both die holders simultaneously.
- **Movable Foot Control** — assures maximum convenience, reduces operator fatigue. Master safety switch on ram slide.
- **Sturdy Welded Steel Frame** — stress relieved, assures rigid die support, provides extra working clearance.
- **Compactness Conserves Floor Space** — 100-gal. oil reservoir in base, motor vertically-mounted at rear, panel-mounted valves.



Right side view of new Pines Press Bender. Note how wing dies are controlled by twin equalizing side-mounted cushions. Extra vertical clearance permits bending 2" O.D. tubes on a 5" center-line radius to 180°.

PROMPT DELIVERY — Write today for more data and prices on the new Pines High Production Bending Press. They are being lot-produced as standard units and prompt delivery can be made on early orders. They are designed and built by America's leading manufacturer of tube bending equipment.

Automatic Benders

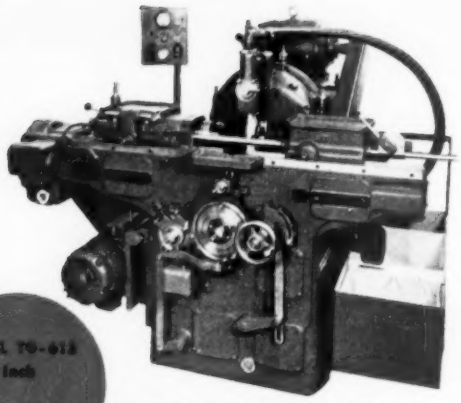
Semi-Automatic Benders

Tube and Rod End-Finishing Machines

Bench-Type End-Finishing Machines

Quality threading

AT MINIMUM COST

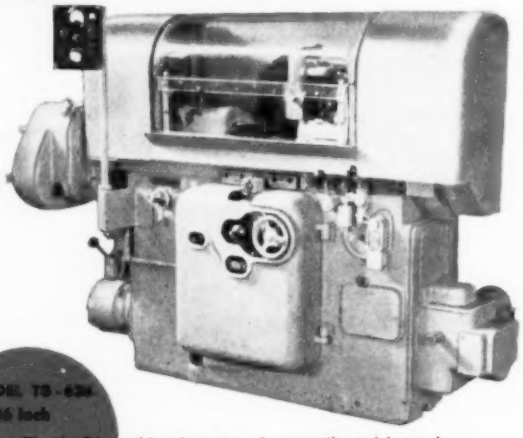


MODEL TG-615
6 x 15 Inch

The 6 x 15 Automatic Thread Grinder is used for high production thread grinding with either single or multi-ribbed wheels on relatively small parts.

JONES & LAMSON
AUTOMATIC THREAD GRINDERS:

- Produce threads of better quality and more uniform finish
- Reduce handling cost
- Eliminate costly rethreading after heat treatment
- Eliminate expensive retooling when specifications change
- Reduce cost of gage maintenance

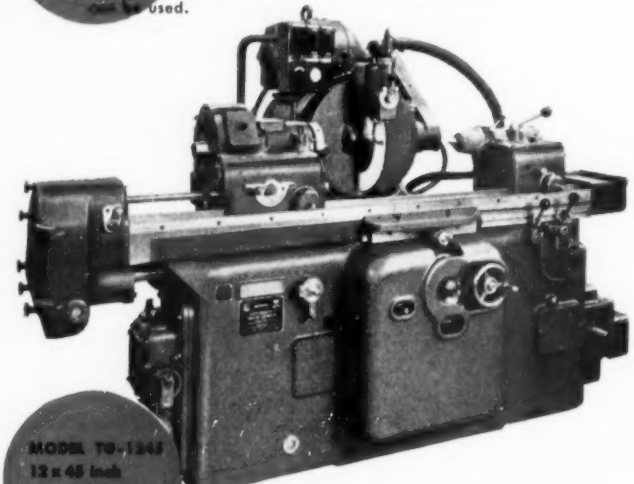


MODEL TG-636
6 x 36 Inch

The 6 x 36 machine is extremely versatile and is used on long or short run jobs on a great variety of precision threaded parts. Single or multi-ribbed wheels can be used.

Built-in accuracy and automatic features, make any of these machines a paying investment for toolroom or production line.

- Automatic wheel truing
- Automatic infeed on successive cuts
- Automatic sizing
- Rheostat wheel speed control
- Diamond or crush dressing of wheels
- Multi-ribbed threading
- Right and left hand threading



MODEL TG-1245
12 x 45 Inch

The 12 x 45 machine is used for grinding threads on a wide range of work from small to large heavy parts. Single or multi-ribbed wheels can be used.

When measuring the value of a thread grinder remember the extra benefits of J & L top-flight construction. Write Dept. 710 for illustrated catalog.

JONES & LAMSON

Machine Tool Craftsmen Since 1835

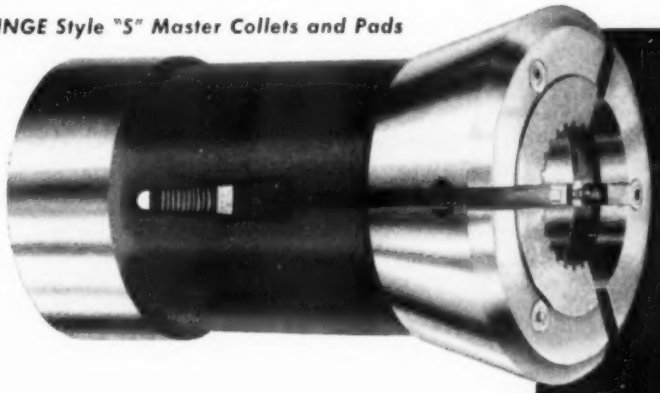
JONES & LAMSON MACHINE CO., 502 Clinton St., Dept. 710, Springfield, Vt., U.S.A. • THREAD GRINDER DIVISION

HARDINGE
ELMIRA, N.Y.

MASTER COLLETS AND FEED FINGERS

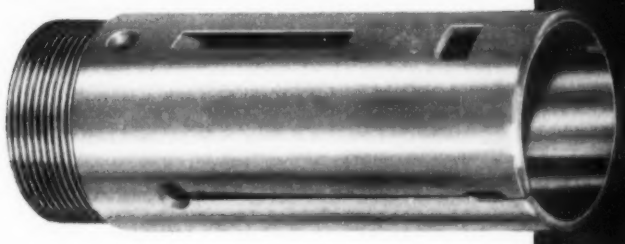
For Progressive Screw Machine Plants

HARDINGE Style "S" Master Collets and Pads

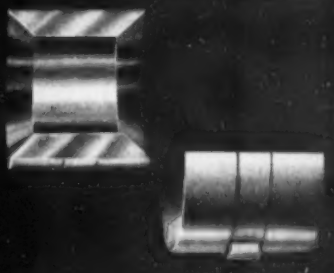


The Only MASTER COLLET
With No Work Pressure
on the Screw.

HARDINGE Style "B" Master Feed Fingers and Pads



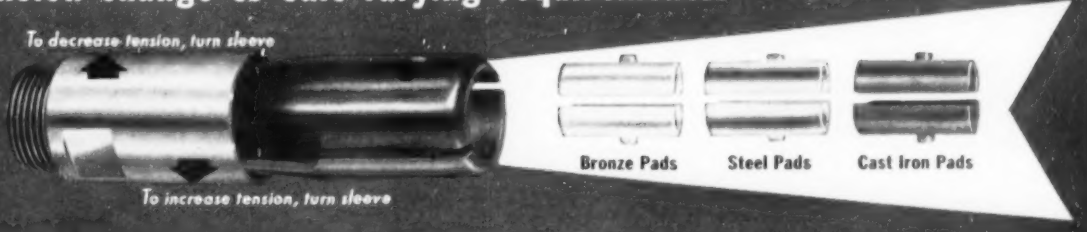
Pads Cannot Work Loose
No Screws No Pins



Pads interchange with Masters for different makes of machines having the same capacity.

Write for descriptive Bulletins.

HARDINGE Master Feed Fingers with Adjustable Tension - provide tension change to suit varying requirements.



HARDINGE BROTHERS, INC., ELMIRA, N. Y.

Keep Your on the OLIVER Line — Cost Cutting Production Boosting MACHINE TOOLS

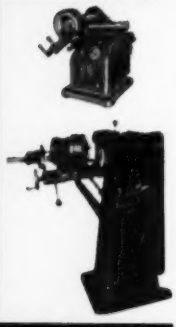
OLIVER DRILL POINTERS

Properly machine ground drills give better performance. OLIVER Drill Pointers, with each lip doing equal work, give balanced cuts—more accuracy—more perfect holes!—more efficiency—longer drill life.

As illustrated:

No. 21 Oliver Bench Drill Grinder. Hand operated for Drills No. 57 to ½".

No. 510. For Drills ¼" to 3". 2-3-4 flute.



OLIVER DIEMAKING MACHINES

Efficient, speedy and accurate — effecting great savings in time and costs. Skilled labor is not required for sawing, filing and lapping operations.

Available in 5 Models.

Bench Model 5-1 (Illustrated) — Single Speed Die Maker for use on Tool Steel up to 1" Thick.

Heavy Duty Model (Illustrated) — 6 speeds; works in metal up to 3" thick, has variable strokes to 5" with hydraulic feed.

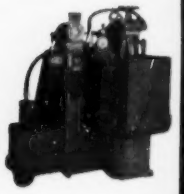
OLIVER ACE UNIVERSAL TOOL & CUTTER GRINDERS

Keep your most difficult cutters sharp with Oliver ACES. They excel on high speed and Tungsten-Carbide work. Direct reading for clearances reduces fatigue — eases operators' jobs.

The ACE excels for grinding face mills up to 15" • also, slab mills • slitting saws • all types cutters and reamers.

2 Models: Heavy Duty (Illustrated) and Standard.

OLIVER 20" TEMPLATE TOOL BIT GRINDER

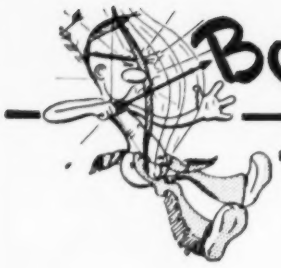


Efficiently powered by a 3 h.p. motor, this OLIVER Machine grinds on the periphery of a 20" wheel. Capacity: tools up to 11½" wide x 13¼" high from 0° to 20° clearance. The OLIVER is developed for production sharpening of single point Tungsten-Carbide and high speed tools—offers increased production, lower tool costs and savings in man-hours. Extremely fine finish assured.

Write Today For Complete Information

OLIVER INSTRUMENT CO.

1414 E. MAUMEE • ADRIAN, MICHIGAN



Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

Loco Tolerances

I note that one of your correspondents, Cliford T Bower, in a letter on the subject of double tolerances, claims that George Stephenson built the first locomotive. As an employee of the firm which supplied the first public railway with its first locomotives, I feel that Mr Bower does him too much honor. In 1769, a Frenchman, Cugnot, built a road locomotive which is still in existence. In 1804, Trevithick built a railway locomotive. George Stephenson's first locomotive, which was driven through gears, came ten years later.

The tolerances on Stephenson's locomotive were probably the minimum possible with the crude machine tools of the day. On modern locomotives of the steam type, tolerances are stated on all important members, except on the boiler, which is "craftsman" built. About one dimension in twenty has a tolerance on the detail drawings. This, of course, leads to many administrative difficulties. For example, it has been suggested that, when comparing the performance of different classes of engines, the records of only the best engines should be taken into consideration. This shows the amount of variation in workmanship. The question of double tolerances is entirely academic in locomotive building.

R Peter Clements
Darlington, England

Old Volumes

I don't know whether you have heard of anyone binding *American Machinist*, but I have eight or ten volumes bound by my father in 1882 or thereabouts when *AM* was the large size. These books are most interesting and I have been unwilling to scrap them, and I am writing to ask what organizations use material of this kind.

I have not made a complete survey of the dates, but one volume is 1882.

H Graham Bertram
32 Cross Street
Dundas, Ontario

Here are some of the difficult volumes to find. If you are interested, drop Mr Bertram a line—Ed.

GRINETICS

BY D G SMITH

FLYCUTTER

COLLET

MOTOR STARTER

DRAG LINK

Republication rights reserved

Pressure Processing

. . . whoever uses it in their production is a customer or potential customer of **H-P-M**

Taming Temperamental MAGNESIUM . . . a Cinch with All-Hydraulic H-P-Ms!

The Emerson Electric Mfg. Co., St. Louis, draws thin magnesium alloy sheets to a depth of 30". To meet the demands of this difficult job, which calls for accurate control of heat, speeds and pressures, H-P-M designed and built this 600-ton *all-hydraulic* press incorporating an extreme range of accurate, stepless speeds (0" per min. to max.) and pressure controls.

When it comes to solving tough production problems . . . it will pay you well to talk shop with an H-P-M engineer about *all-hydraulic* pressure processing and H-P-Ms. Write today!

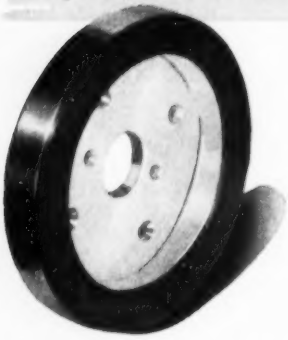
HPM

THE HYDRAULIC PRESS MFG. CO.

1002 Marion Road, Mount Gilead, Ohio, U. S. A.

Presses for Every Pressure Processing Application

Grind More Carbide *per Carat of Diamonds*



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Wickman-Neven Steel-Bonded Diamond Wheels stretch wheel life—lower your carbide grinding costs because they're practically indestructible. They can't be damaged even by plunging sharp-pointed tools into them. Diamonds stay in place until worn to give more cuts per carat. These wheels also give up to 300% longer carbide tool service by producing a strong, uniform cutting edge that resists breakdown.

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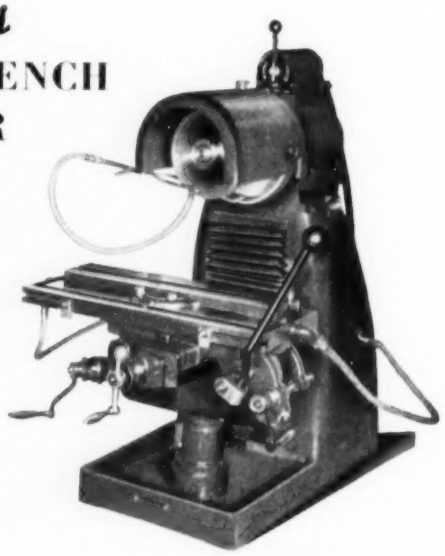
Powered with a 1 HP reversible motor, the Wickman Model GF-3 is designed especially for carbide grinding with steel-bonded wheels or chip breaker grinding. It makes carbide cut-off work with steel-bonded wheels easy, economical. Built-in coolant pump and swivel table facilitate tool grinding with metal-bonded flaring cup wheels.



For the complete story on Steel-Bonded Diamond Wheels, Resinoid-Bonded Diamond Wheels and Wickman grinders, write on your letterhead for this new 24-page catalog.

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Dollars for Doughnuts

In reading over the account of the gear with the split personality, (*AM*—Feb 2 '53, p129) my thoughts reverted to some years back when my Dad suffered considerable disappointment because of an accidental split. Dad had "tore in" and made up a large hob to cut a badly needed worm gear and it cracked in hardening. Like many a man in a pinch, he got an idea just before sleeping and put it into effect the next day. He made up a couple of collars and shrunk them on the ends of the hob. Needless to say, the gear was put out without delay.

If anyone has a hard time digesting that one, let him stick around! The companion story is about a large spur gear, about 4 ft in diameter, that cracked three of its six spokes near the hub. It was the manager of a clay-products plant who had the split personality over the fact that it would take about a month to get another gear from the manufacturer in the east. What could we do to help him? Welding torches were not available, so the foreman of the foundry was called in. "Let's put the gear in a flask," he suggested, "and I'll sweep out a chunk of sand around those spokes and hub, and pour in a patch."

Next morning we took out the gear and, believe it or not, there was a big synthetic doughnut around that hub, clinging for dear life. That was 35 years ago and I wouldn't be a bit surprised if the gear isn't still doing duty. Inasmuch as the foundry foreman wasn't any Michelangelo, he did the best he could with his trowel and the result was something like a rheumatic hippo. Nevertheless, beauty is only skin deep in a clay products plant, so what the heck! Who cares for appearance when dollars are at stake? I don't know who first said it, but it is true: Necessity is the mother of invention.

John Homewood
Ontario, Calif

Toolmaker's Plug

I read with amazement the letter, "Toolmaker's Gripe," by A T Renson, (*AM*—March 30 '53, p 74).

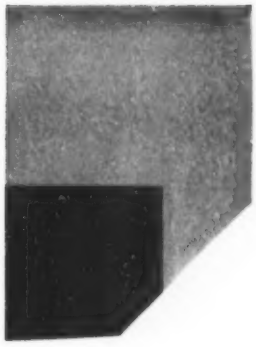
I can sympathize with his complaint about inaccurate tools, but I find it hard to understand his question, "Why can't tools be made to stay accurate even under abuse?" Why should a man who calls himself a toolmaker abuse his tools? Is not part of the skill of an artisan measured by the use and care of the tools of his trade?

Then we come to the subject of angle plates. Mr Renson intimated that there are 26 toolmakers in his shop and that there is not an accurate angle plate in the whole shop. Apparently no one in the shop ever heard of Sir Joseph Whitworth, described by some as the father of the modern machine shop. I believe it was Whitworth who first devised the method of originating surface plates and angles. May I respectfully refer Mr Renson to a small book, *Methods of Machine Shop Work*, published by McGraw-Hill Publishing Co, which describes the above methods?

May I point to the fact that somewhere, sometime, man produced results that were more accurate than the tools he used? Otherwise we could never have achieved the degree of accuracy we have today. Accuracy of form, size, and position do not occur in nature; therefore, from necessity, tools had to be produced that were more accurate than the tools which made them.

It has long been my contention that a master craftsman, or a group of craftsmen, could be put on an isolated island and, given enough time and raw materials, could produce a modern machine shop. True, it would be a long and laborious process, and if the system of linear measurement coincided with existing systems they would need one master, but they would need no master for angles, flat surfaces, straight edges, or circles.

C F Welch
Cottondale, Florida



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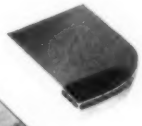

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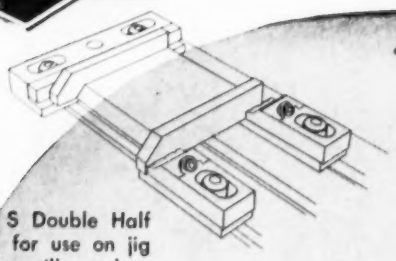
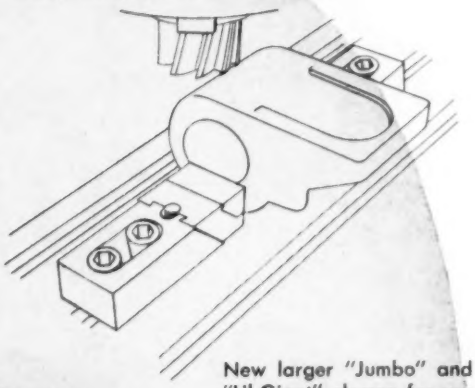


J & S Double Half Vise, for use on jig borers, millers, planers and shapers.



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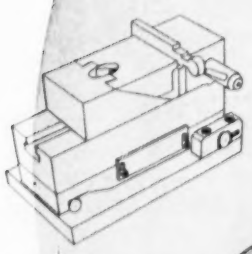

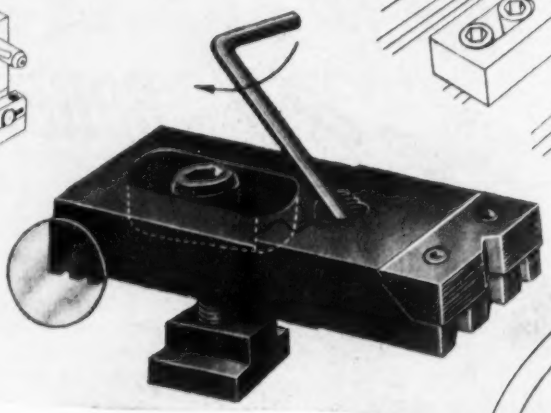

Precision Grinding Vise with or without sine bar allows rapid unloading and exact relocating.

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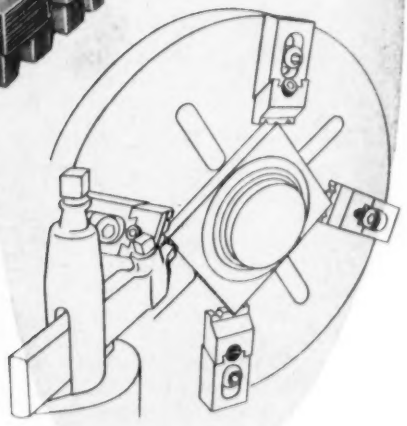

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eliminate elaborate set-ups and operations

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dress two angles tangent to a radius in one continuous motion

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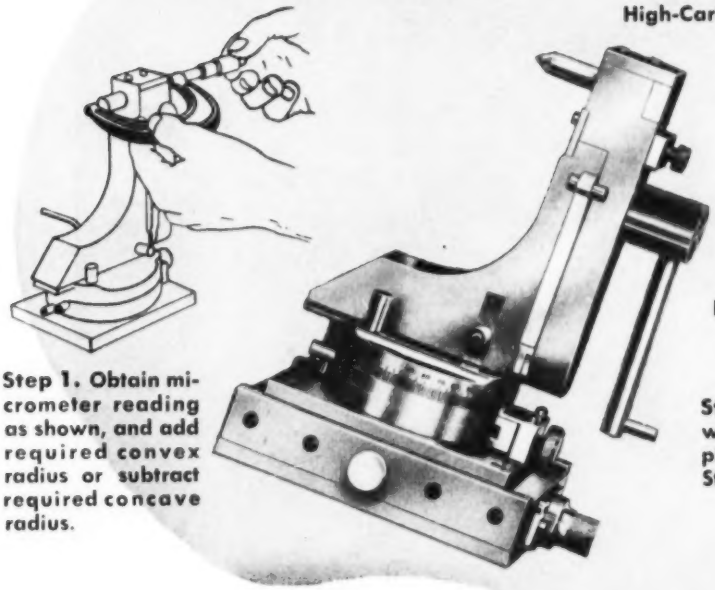
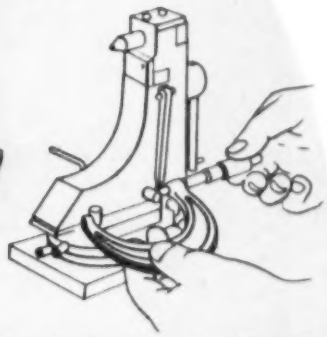
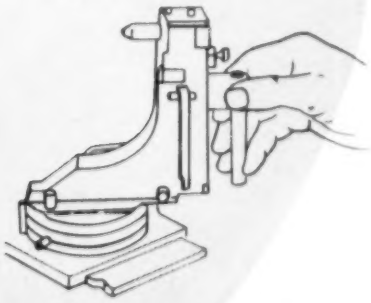


Step 1. Obtain micrometer reading as shown, and add required convex radius or subtract required concave radius.



Step 2. Next loosen gib with wrench and "mike" over lower pins to reading obtained in Step 1.



Step 3. Tighten gib; set stops for two angles; ready for action.

ADAPTABLE TO ALL TYPES OF CYLINDRICAL AND SURFACE GRINDERS

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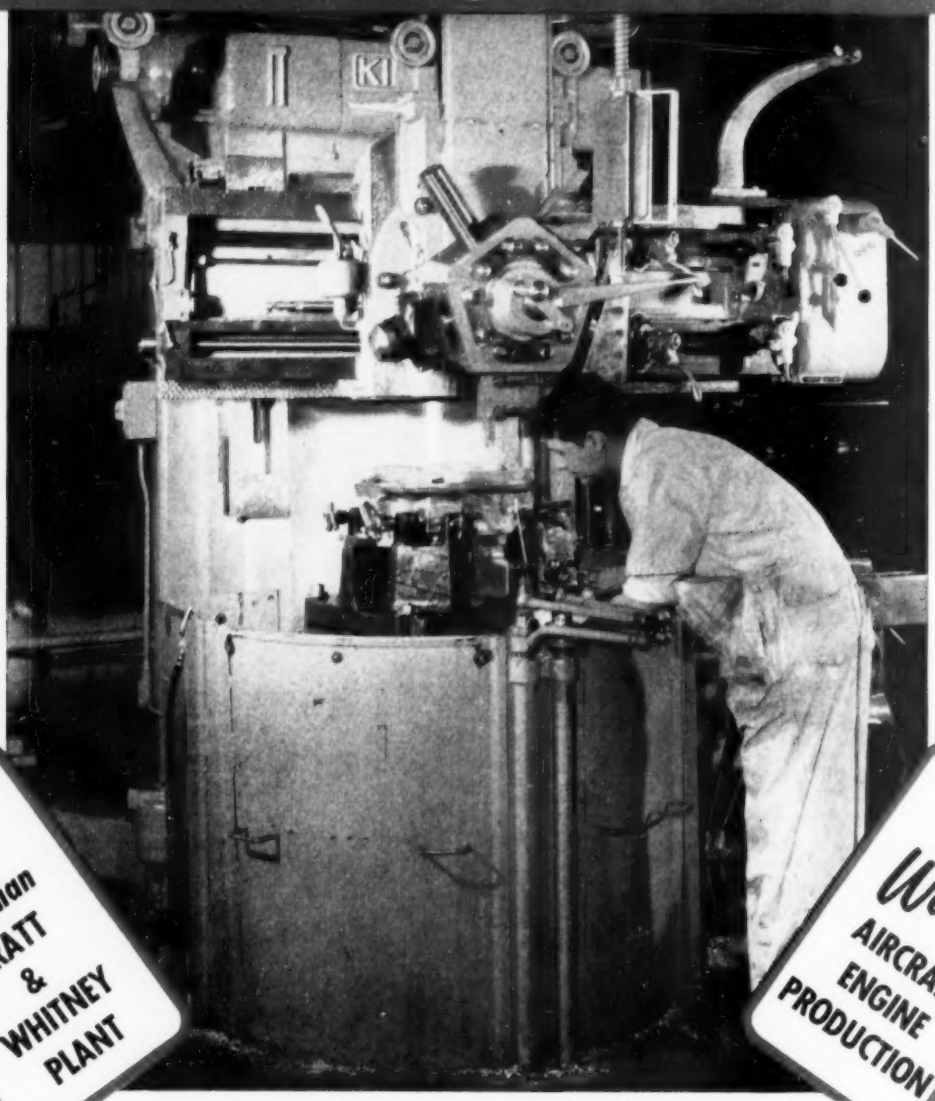

AT New Canadian PRATT & WHITNEY PLANT

ON Wasp AIRCRAFT ENGINE PRODUCTION

One of the KING machines at Canada's new Pratt & Whitney plant. This is a 36" mill, shown machining rear crankcase section of the Wasp aircraft engine.

It's only natural that KING Vertical Boring & Turning Machines should be making a substantial contribution to Canada's, as to America's defense effort. Defense production, particularly in aircraft engine manufacture, demands utmost precision. That's where KING is in a class by itself. KING mills have the extra weight, rigidity, and accuracy that assure maximum stock removal without sacrificing precision or quality of finish. KING machines are made in ten sizes, from 30" to 144", all available in a variety of head combinations. For complete details it will pay you to contact your local KING Distributor —or write us direct.

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SPOT NEWS of Metalworking

- **Shielded enclosure to cut out electric equipment interference** with radio and TV channels meets Federal Communications Commission certification requirements. Induction heaters, welding equipment, etc, can be placed inside galvanized-steel screening panels, effectively shielding emission of radio-frequency energy. Incidentally, the FCC plans to crack down on offending equipment, beginning June 30, and already has mobile direction finders patrolling industrial areas on the lookout for faulty installations.

Small Defense Plants Administration has issued a "specifications Directory" to assist small metalworking companies in bidding on defense contracts. The Directory is a nationwide listing of places that maintain either partial or comprehensive files of standard government, military and civilian specifications that may be consulted by businessmen. The Directory is being issued to all holders of the Government Procurement Manual.

- **Government may get out of the lending business** if either of two bills before the Senate banking Committee is passed. The first would create a regional system of investment companies financed by private banks. The other would authorize the Federal Reserve System to guarantee up to 90% of private loans to small business.

- **Reinforced plastic tanks for fresh water and oil storage** are being installed experimentally on five Navy minesweepers. The fiberglas plastic tanks take the place of monel and aluminum tanks. New design is 30 to 40% lighter and is corrosion resistant. Sizes range from 100-1687 gallons.

British pressed metal industry does a better job than the US industry in "improving worker morale, and consequently productivity, through maintenance of excellent welfare programs and good working conditions," states a report of a team from the US industry that visited Britain. The team found that managers of pressed metal shops in Britain were younger than those in comparable jobs in America, yet had equal responsibility.

- **Machine tools and entire tooling from defense plants** converted to production of civilian goods will be kept intact in new storage buildings to be erected alongside existing factories, if Office of Defense Mobilization has its way. Tank plant converted to automobile assembly purposes would be good example. This method would keep intact the core of skilled manpower and supervision as well as defense production equipment.

- **Soviet bloc has offered to supply general-purpose machine tools to the West** in recent multilateral trade talks at Geneva, Switzerland. Hungary suggested in the same talks that it furnish road-building machinery to western nations.

- **Defense contractors with facilities contracts have received letters** from General Services Administration asking them what they wish to do with government-owned machine tools in their plants after their defense work is completed. Do they wish to lease them on a monthly loan basis or perhaps buy them?

- **Vacations for employees have been greatly liberalized in Cleveland plants** the past three years, an Associated Industries of Cleveland study shows. Today 97 companies employing 81,881 workers give 15-days' vacation after 15 years of service. In 1950 only 20 of the 97 companies granted that much paid vacation.

822

PIECES PER HOUR

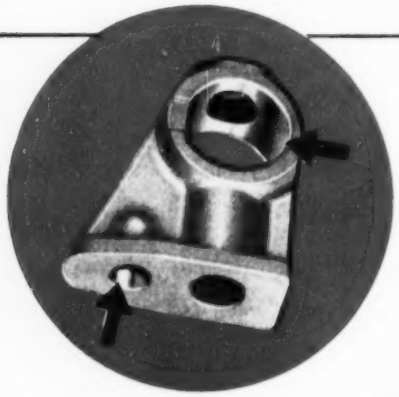
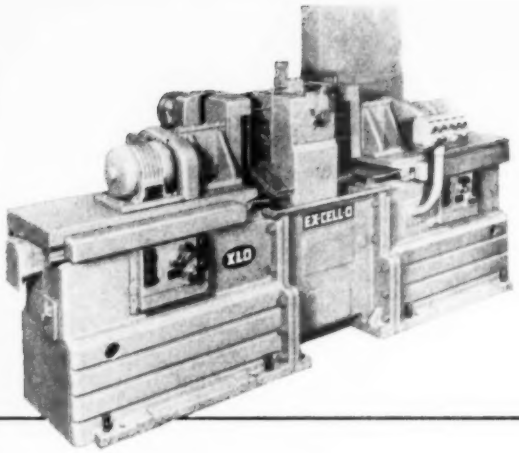


Photo above shows one of the die-cast aluminum workpieces. Arrows point to the bored holes which are held to plus or minus .0005". Four parts are machined during each cycle, netting 822 pieces per hour.



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Ask your local Ex-Cell-O representative about all the other advantages of Ex-Cell-O Way Machines, or write today for Bulletin 31631.

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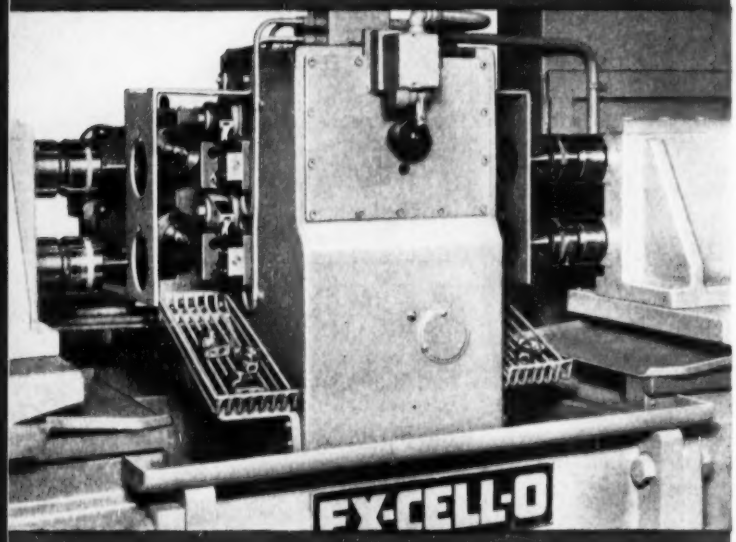

Two parts are held in each side of the fixture. Left and right slides bore 13/16" diameter hole through each part, while rear slide is boring 5/16" blind holes at right angles to the others. The work is unclamped and ejected automatically at the end of the machining cycle.

EX-CELL-O CORPORATION

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53-22

Washington

Defense mobilization planners in the various departments and independent agencies are now working—like they never did before—as members of one team. ODM Director Flemming has made "teamwork" among the mobilization agencies his big pitch.

His Defense Mobilization Board, which consists of seven Cabinet officers and the heads of MSA and the Federal Reserve System, is meeting weekly. During the previous administration, DMB met only every other month for the most part. This was one cause for diffusion of responsibility and frequent aimlessness in previous mobilization planning.

First order of business for Flemming is the development of "meaningful" requirements information by the Pentagon. He considers this the basis for his mobilization planning. Other points on his agenda: revision of stockpile objectives to tie into new requirements; review of expansion goals to relate the programs to changes in the defense buildup.

• • •

ODM has carefully drafted a basic policy statement on the question of the mobilization base. It's supposed to reconcile viewpoints within the administration on what has become a very touchy subject. The President himself has worked on the statement. It will try to make the administration's policy consistent and to show that there really isn't any serious difference of opinion between Defense Secretary Wilson and others. ODM officials are now waiting for an appropriate occasion to spring the statement.

• • •

The outlook for additional aluminum expansion by new domestic producers is bleaker than ever. The tight money market had just about killed off plans of two would-be producers, Olin and Wheland. Now, a new Alcan sales deal with Alcoa and Kaiser, which will boost US primary aluminum supplies by 786,000 tons during the next five years, may be the death blow to the two potential aluminum firms.

Olin and Wheland have been unable to get private financing for aluminum plants without government loan guaranties. ODM's ground rules for the last round of aluminum expansion excludes this type of aid. But a change was being considered. The defense mobilizers were taking another look at long-range aluminum requirements. If warranted, they were prepared to loosen the tight money rules in the interest of more aluminum. Reynolds Metals had been given a loan guaranty in the earlier days of post-Korea aluminum expansion.

The Alcan deal on aluminum from new Canadian capacity takes ODM out of a hole. This additional tonnage—which will be fabricated by Alcoa and Kaiser—exceeds the Olin-Wheland annual potential.

• • •

The Air Force is taking a big risk this time in taking its fight against a budget cut to Congress—as it did back in 1948. Then, Congress voted some $800 million over what Truman asked for. Air Force felt safe about it, since they—and everyone else—figured Truman was in his last term at the White House. Truman responded by impounding the money.

Wrangling that's beginning all over again will be so hot, heavy, and confusing, you'll have a hard time telling what all the shouting is about. One thing it's about, for sure, is some $5 billion to be spent for aircraft procurement.

But once you get beyond that idea, you get into real quicksand made up of technical Pentagon jargon and figures that run mostly into billions of something or other.

• • •

Air Force uses a sort of Alice-in-Wonderland lingo to describe its parts. Principal division of the Air Force is an air wing; it breaks down into groups, squadrons, divisions, and flights.

Air wings can't be compared, say, to an Army division which has roughly the same number of men, regardless of its type. Wing sizes range from 15 planes for a heavy bomber wing, to 30 planes for a medium fighter outfit, to 75 planes for a fighter wing.

Transport and support wings can vary all over the lot in numbers of planes and men.

To further confuse the issue, the Air Force never announced just what kind of wings would make up the 143 wings approved by the Truman administration. Only breakdown made public was that by 1956 the plan called for 125 combat wings and 18 transport wings.

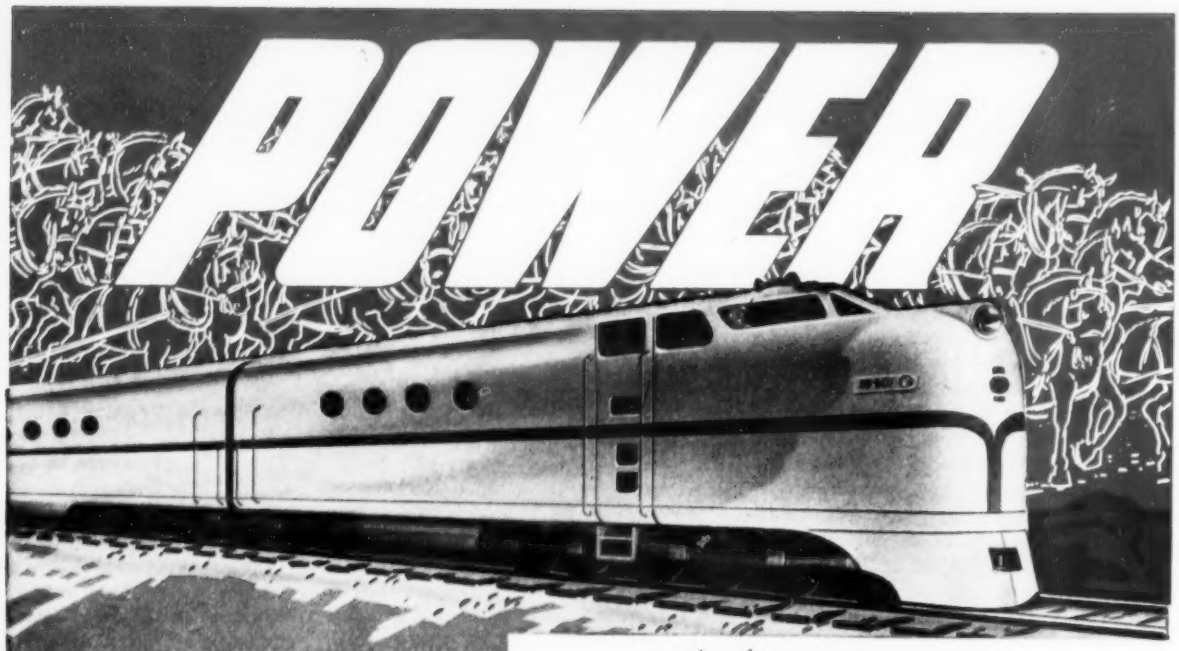
• • •

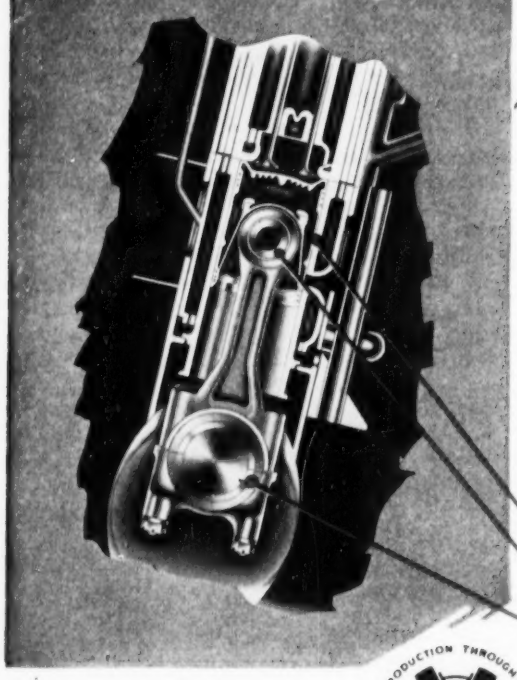
Taft-Hartley revision this year grows dimmer each week. Seems nobody really wants it badly enough. Administration is split between Durkin and Weeks. Democrats want repeal. Labor doesn't like amendments this Congress has in mind anyhow. And management seems satisfied.

Promises to fix up law next year won't carry much weight. Congress is sensitive to controversial legislation in election year.

General Motors and Ford settlements with UAW-CIO perked up Washington hopes that basic steel will settle without a strike, too. Auto workers now get about seven cents more than a year ago. It could tip the steel increase into the 7-10 cent bracket.

POWER





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Because diesel engine parts must be able to bear and deliver tremendous power, important load-carrying surfaces are Microhoned.

The Microhoning process develops a surface that can withstand intense force. There is no torn, burned or smeared metal that might flake or wear off quickly. All the bores are round, straight and accurate to close tolerances.

THAT'S WHY—the cylinder liner,

—the cross head,

—the connecting rod . . . all which must hold the compression and transmit the terrific thrust are MICROHONED!

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Detroit

So far as machinery makers are concerned, the big thing about the General Motors deal with CIO's Auto Workers was the raise for skilled men—10¢ an hour. UAW had been asking 28¢; GM had previously offered a nickel. The raise straightens out historic differentials.

The value of the GM boost generally was about 3¢ beyond what the contract (supposedly closed till 1955) called for. Had there been no change, the annual raise of 4¢ would have been paid at the end of May, less 2¢ decline due to a lower BLS price index figure. However, under the new setup, the index bonus stayed unchanged, and the annual raise became 5¢. Difference: 3¢.

The 10¢ raise for tradesmen, while less than they wanted, will stick. Nevertheless, there'll be wailing—UAW's tradesmen are voluble.

The settlement, in any case, does a lot for labor peace this year and next. That, however, discounts one possibility of trouble—a furore over pensions at Ford. Ford may be disinclined to do anything in that area; UAW plans that it will.

In all probability, the contract opening at GM will lead to a receptive frame of mind in the union if the company comes back in 1955 and wants another so-called long-term contract ("so-called" because the only way UAW will buy one is on the basis that it can be reopened if circumstances warrant).

Further on labor, production schedules generally were being larruped late in May by two tieups—at Ford's Canton forge, and at Borg-Warner's Warner Gear Div., at Muncie. Both arguments resolve around standards difficulties, tough to settle unless the parties want to settle. At Ford-Canton the UAW didn't; it was a club on Ford for the national negotiations.

What with Ford shutdowns almost everywhere on this account, and other contractions accrued from the Warner dispute, auto production failed fast at the turn of the month. It dropped down below 150,000 units a week, cars and trucks, U. S. and Canadian included. The Warner Gear tieup looked like a continuing brake, reducing levels lower and lower everywhere. Barring that, schedule projections continued high.

• • •

After many delays, a fine new automatic transmission is in volume production at Chrysler Division's Indianapolis transmission plant. With planetary gears, it moves through two stages automatically and all but imperceptibly, and linkage through a torque convertor provides complete smoothness.

On this score, Chrysler is doing some retooling in its Dodge division automatic transmission line, indicating the possibility of new things there at the end of the year.

Largest retooling activity at the moment, however, is at Ford. Apparently when that company said it was going to spend a half billion dollars more, it certainly wasn't fooling. One large share of the program: A new tractor engine, a new tractor transmission, and much else that will be new in the tractor.

• • •

The Pontiac engine program seems a little sidetracked for now. Some thinking is that Pontiac will use the Oldsmobile block and build a modified engine from it for 1955.

Chevrolet keeps ordering tools for its new V-8 engine, projected for 1955 model installation.

• • •

When Ford, Chrysler and Fisher Body trotted out the first M48 tanks last year, wide publicity was given the fact that the huge hulls were being cast in one piece, something never before attempted in tank production. The Patton has now passed all its tests and is being placed in the hands of troops. But the hull is no longer one-piece.

Ordnance discovered that foundry capacity for producing the one-piece hulls is definitely limited. Furthermore, such hulls are extremely heavy, hard to handle. Result: Ordnance spread the work out to take advantage of all available foundry facilities, large and small. The hull now comes into assembly plants in 11 pieces which are welded into a single component.

With the tank program being cut back, sentiment at Fisher's Grand Blanc tank plant is that the plant should be kept in a "simmering" stage, rather than converted to some other use. Plant management would prefer to see M48 production continue, even if it is all but motionless, rather than see the plant used as a storage warehouse or whatever. Thus, in case of an all-out effort, production could go to full capacity almost at once.

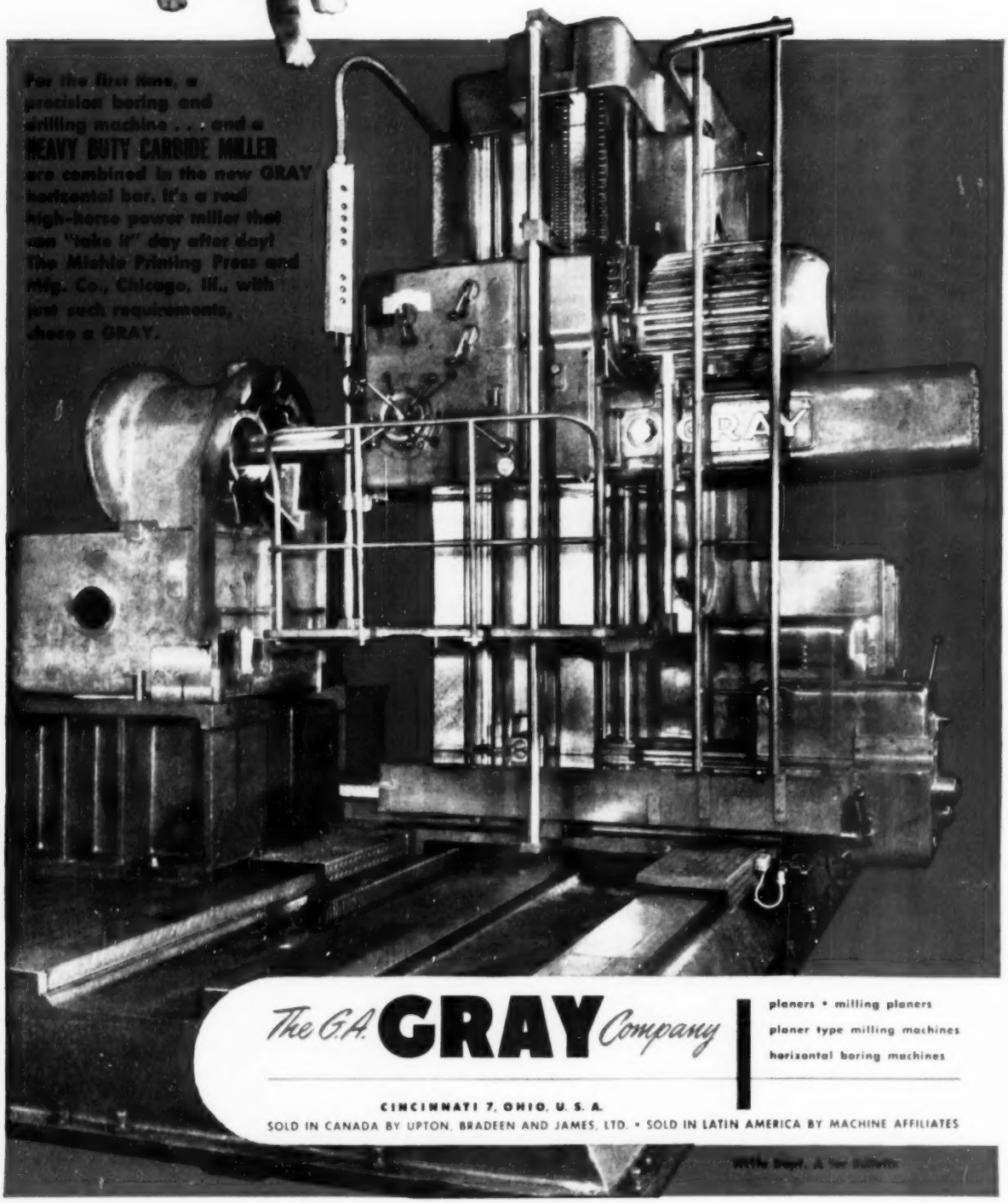
Business conditions, if Detroit purchasing agents can be believed, have slackened off a bit. The monthly survey of the purchaser's association showed a considerable drop in the number of buyers who thought business was better, and an equally impressive increase among those who thought business was worse than a month earlier. The inventory tendency seemed to be up; employment was down from its March peak, they reported.

• • •

The annual technical meeting of the American Society of Body Engineers is scheduled for Oct. 28-30 at the Rackham Bldg., Detroit. Eight technical sessions are included, and a large display of supplier and parts makers is being arranged.

YOU.....DON'T "PUSSY FOOT"

WITH A GRAY


For the first time, a precision boring and drilling machine . . . and a HEAVY DUTY CARBIDE MILLER are combined in the new GRAY horizontal bar. It's a real high-horse power miller that can "take it" day after day! The Michle Printing Press and Mfg. Co., Chicago, Ill., with just such requirements, chose a GRAY.
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Machine Tools

Some government agencies feel that there no longer is a need for pool orders. Hence the pool-order program should be completed as soon as possible.

General Services Administration would like to cancel pool orders if it can be done without hurting the machine tool industry.

• • •

NPA for some months has been reducing government commitments for pool orders. In many cases special machines have been cancelled when the end item involved has been changed in design so that these machines are not required.

All but three of the 67 outstanding pool contracts will expire before the end of the year. So certain officials are advocating letting these contracts run their natural course.

At last count, 281 machine tools had been taken by GSA from pool contractors at 82% of the market price. These machines now are for sale. They include many standard machines.

It is estimated that GSA will come out of the pool order program with not more than $15 million tied up in machine tools in storage. It has handled some $1.5 billion of pool contracts.

The armed services are reported to have notified civilian defense agencies, through a letter from the chairman of the Munitions Board, that they will not be responsible financially for settlements with builders arising from cancellations or terminations of pool orders.

Defense officials can hardly be expected to take kindly to this proposal. They admit that Pentagon has no legal obligation. But it certainly has a moral one. After all, the pool order program was initiated to hasten armament production for the Army, Navy and Air Force.

• • •

Mutual Security Administration has authorized financing of $750,000 of U.S. machine tools for artillery shell production in a plant in Turkey. Beyond that, $1 million may be granted by MSA for more machines for the same project.

Turkey's participation in the MSA program includes a shell production line, a powder factory and modernization of a brass mill.

• • •

An arsenal in Portugal already has placed orders with U.S. companies for $1.2 million of production equipment.

Fiat will formally have allotted orders for $3.6 million of U.S. machine tools, through MSA financing, by the time you read this page.

The machines will go into tooling for manufacture of Allison jet engine parts.

• • •

American machine tool builders are in the final stages of cleaning up deliveries on the program involving $130 million of machines for Britain's defense production and $30 million for the French.

• • •

The hot squabble over possession of the Central Inventory of machine tools owned by the government is about to be resolved by proclaiming Pentagon as the victor.

Defense Mobilizer Arthur Flemming, Secretary of Commerce Weeks and Deputy Defense Secretary Kyes got into the act toward the end.

The deciding argument seemed to be the indisputable fact that the armed services own the machines. It was proposed that NPA should have a hand in administering the Inventory, even if Pentagon gets back the day-to-day operation. But Mr. Kyes is reported to object even to this concession.

• • •

Perrin G. March III, president of the Cincinnati Shaper Co, will take over as director of the Metalworking Equipment Division of the National Production Authority on or before July 1.

NPA, by then, will have a new name, but will be housed in the same place—the New GAO Building at Fifth and H Streets in Washington.

NPA'S 32 industry divisions are destined to be cut down to 17. The Metalworking Equipment Division, with 40-odd employees, will be the second largest division. Steel, with around 100 people, will be the biggest.

A permanent deputy director of the Metalworking Equipment Division is to be appointed. He already has been selected, but formal announcement is being withheld until his transfer from another government agency can be completed.

He is well known to the machine tool industry and has been in Washington for many years, doing an able job.

Mr. March probably will be in Washington until the end of the year. The director of the Metalworking Equipment Division will continue to be chosen from the production equipment industry on a rotating basis, as in the past.

Earl J. Leeds, who has headed the Metalworking Equipment Division in recent weeks, will return to the Brown & Sharpe Mfg Co as sales manager of milling machines when Mr. March takes office.

• • •

Machine tool sales dipped in April to 277 on the index of the National Machine Tool Builders' Association. The March figure was 323.3.

Shipments stayed close to the March level. The April index figure was 373.1 (March was 375).

BF

News About Created-Metals

Cuts Inventory 50% with Standard Tools

A leading appliance concern recently reported: . . . "As a result of suggesting to the responsible Process Engineering group standard tools which would perform the same service at an initial purchase saving, as well as a substantial saving in procurement time, our inventories of so-called special cutting tools have been reduced by more than 50%."

News about the new Carboloy MTI Plan indicates that it is designed to work similar benefits for cutting-tool users.

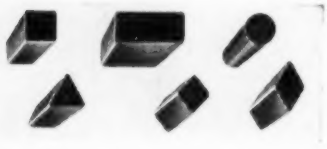
Details can be had by writing the Carboloy organization (address at right).

★ ★ ★

Complete Line of Insert Blanks

With the addition of two new diamond-shaped styles, the Carboloy line of carbide blanks for insert tools is now complete.

Available in 12 sizes, the styles



are square, rectangular, round, triangular, 55° diamond and 80° diamond. Blanks are available from Carboloy stocks or from Authorized Distributors.

★ ★ ★

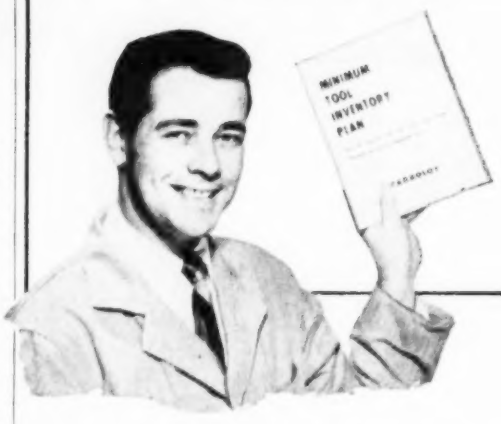
New, Free Magnet Idea Kit for Shops

A handy, new literature kit showing the how's and why's of permanent magnets is currently sparking shop men to real savings in time and money.

The magnets have proved very effective as sheet steel separators, magnetic stands, tool-holding devices, sweepers' "pickup" tools and tool retrievers, to name a few uses.

Kit can be obtained free from Carboloy Department of General Electric Company. (See address at right.)

YOUR CARBOLOY FIELD REPRESENTATIVE SAYS . . .



"This reduces

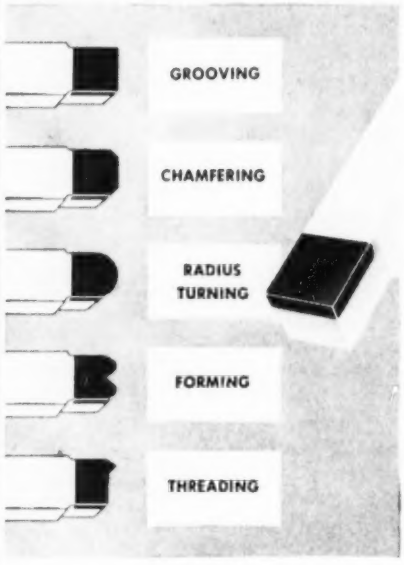
"It's an astoundingly simple, practical way for you to benefit from the low cost, wide adaptability and quick availability of Standard Carboloy Tools.

"Briefly, here's how the Minimum Tool Inventory Plan works: Instead of loading your shelves with special, made-to-print single-point carbide tools, you stock a lesser number of Carboloy 'Standards' . . . always available from distributors' stocks nearby. The MTI Plan shows you how to convert these Standards, *in minutes*, to handle about 80% of your special jobs.

"Your operating efficiency stays at par or improves. Your inventory goes down – about 30% or more. You cut out tooling delays, save on initial tool investment and tool cost. You streamline your inventory procedures, reduce tool waste . . . get many other benefits shop-wide.

"Send coupon for MTI Plan Kit."

1 ADAPTABLE for up to 80% of your single-point tool jobs



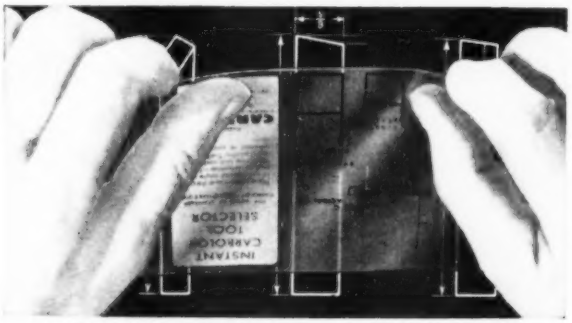
Above is a Style C Standard Carboloy Tool. It can be used "as is" for some jobs, or ground quickly to many special shapes. Five typical ways it can be adapted are shown.

There are only 11 styles of Standard Carboloy Tools . . . ready to be used "as is" for general turning, facing and boring . . . or quickly ground on regular carbide grinding equipment to fit those tricky special jobs. With Standards, you need *fewer* tools to do *more* jobs. Thus, you operate on lower inventories.

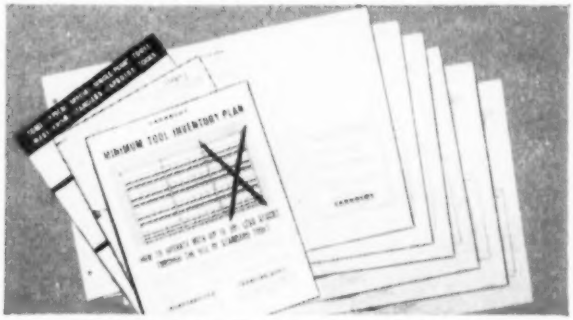
2 AVAILABLE always from nearby Carboloy distributors

You can get off-the-shelf delivery on Carboloy Standards in 98 cities from coast to coast. No waits. No production delays as with special, made-to-print carbide tools. Knowing you can get such speedy delivery of Carboloy Standards means you can cut your inventories still more.

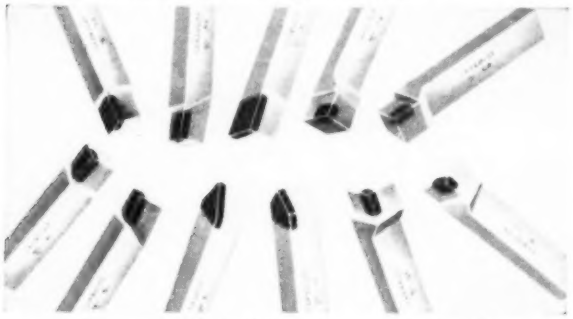
new Carboloy MTI Plan
your tool stocks up to 30%"



3 **Free MTI Plan Kit** includes two handy tool selectors. You place them over your special prints, find out quickly which Carboloy Standard best adapts to each job. Selectors are of transparent plastic.



4 **Kit also includes** Plan Sheets in which to tabulate your Standard Tool selections, and easy-to-follow Grinder Sheet which outlines simple way to convert the Standards to your job specifications.



5 **At once you'll see** how you can operate with up to 30% fewer tool stocks. Next step is to phone your nearby Carboloy Distributor for swift delivery on *only* the Standard Carboloy Tools you need.

6 **Should you have** the slightest difficulty getting the plan rolling, a Carboloy sales representative will call at your plant, help you smooth out the kinks. His expert services won't cost you a penny.

SEND COUPON TODAY—PINNED TO YOUR COMPANY LETTERHEAD—
FOR YOUR FREE MTI PLAN KIT

CARBOLOY TOOLS ARE STOCKED COAST TO COAST BY

AUTHORIZED CARBOLOY CEMENTED CARBIDE DISTRIBUTORS

Look under "Tools" in the Yellow Pages of your local telephone book or in Thomas' Register for your nearby Carboloy Distributor. He has complete local stocks and services. Ask him about the MTI Plan.

"Carboloy" is the registered trademark for the products of the Carboloy Department of General Electric Company.

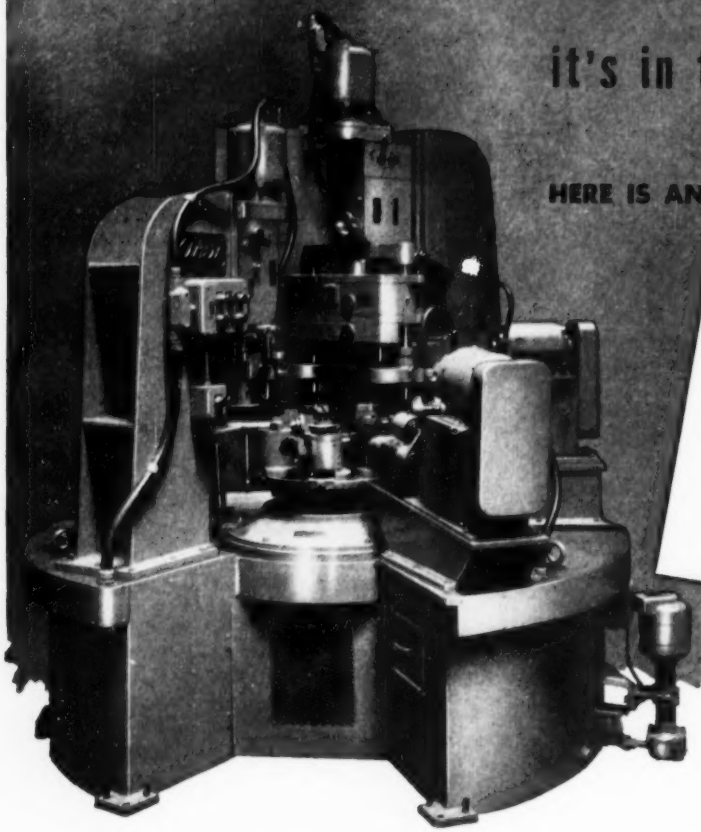
CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY
11149 E. 8 Mile Ave., Detroit 32, Michigan

☐ Please rush me, at no cost or obligation, your MTI Plan Kit.
☐ Have your sales representative call, without obligation.

Name _____ Position _____
Company _____
Address _____
City _____ Zone ____ State _____

If it's SPECIAL...

it's in the Avey line!

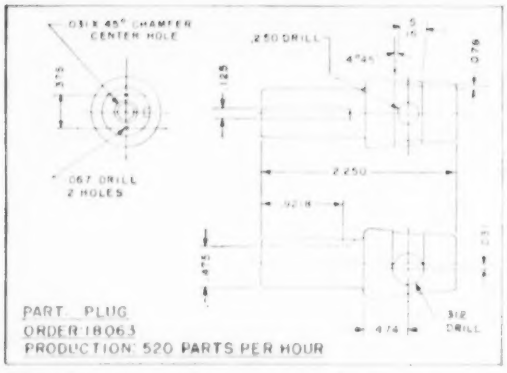


HERE IS AN EXAMPLE . . .

PART	Control Plug for Gas Stove.
PRODUCTION	520 Parts Per Hour at 100% Efficiency.
MATERIAL	Aluminum.
MACHINE	S. O. No. 18063—Consists of five No. 1 Avey Automatic Cam Feed Units, mounted at suitable angles around one 20" Avey Automatic Index Table. All Units arranged on one fabricated steel base which contained suitable coolant system and chip disposal.

SEQUENCE OF OPERATION

Station 1	Load and unload by quick-acting crank type fixture.
Station 2	Mill .125 slot.
Station 3	Drill one vertical .057 hole and one horizontal .250 hole.
Station 4	Drill one .057 hole and one 5/16" hole.
Station 5	Chamfer 3/16" and mill slot between the two .250 holes.



Consult the yellow pages in your phone book—under Machine Tools—for our nearest representative, or write direct to our factory.

Avey

Special Drilling and Milling Machine

Push button control! You just press the button and—bingo!—a finished part.

Operations like this mean maximum efficiency, even with unskilled help—reducing cost of piece, and part wastage.

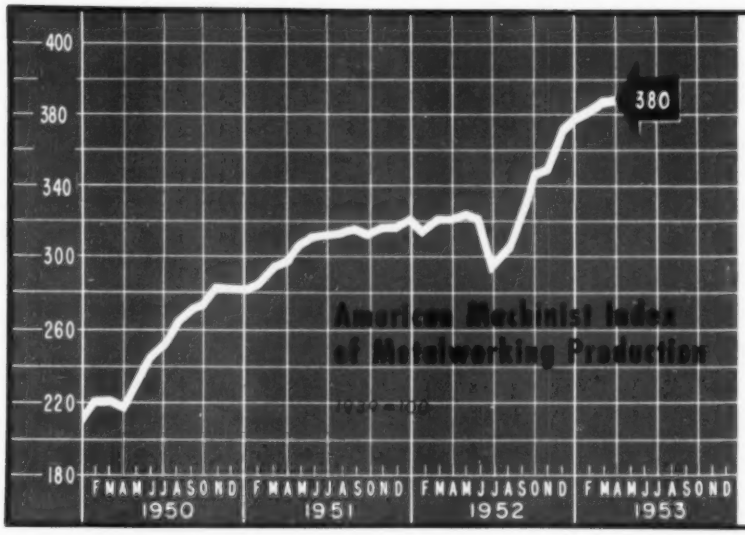
You will also be pleasantly surprised at the "Preventive Maintenance" built into this machine. The entire machine is made up of unit assemblies that have been time-tested and proven.

You don't gamble when you buy an Avey Special Machine—you can be sure.

Avey DRILLING MACHINE CO.

CINCINNATI 1, OHIO

Gaging Metalworking



PRODUCTION INDEX

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	MAY '53(*)	APR '53(p)	MAR '53(r)	APR '52
Tot. Index	**380**	**378**	**378**	**318**
Machinery	343	348	318	
Electrical Machinery	424	420	350	
Autos	311	308	226	
Other Transportation	623	621	503	
Other Metalworking	359	358	309	

(*) Estimated (p) preliminary (r) revised

The metalworking production peak is believed to have been reached and the next move will be downward.

Chances are that the May record, as reflected by the American Machinist index, will register a decline. The slowdown in automotive manufacture, stemming from strikes, will be responsible.

• • •

Durable goods sales are falling under the recent boom volume. They are more likely to go down than up during the next few months.

But don't get the idea that the bottom is going to drop out of Metalworking operations. Production still will be huge by comparison with any previous period except for the World War II peak.

• • •

Aviation still is the strongest segment in Metalworking. Manhours worked in the aircraft industry are about 35% greater than a year ago and may go higher. Sample: Boeing will add 1600 workers at Seattle and Renton, Wash., by mid-July, increasing total payroll to 32,700.

• • •

Despite the drop in automotive assemblies, the rate is of near-record proportions. General Motors will hit a new all-time high the first half of this year, surpassing the 1950 record.

GM car dealers are reported short of normal stocks in almost all passenger car lines.

• • •

Farm implements and tractors are not doing so well. International Harvester, for one, cut back farm tractor production 25% on June 1 at its Louisville, Ky., factory.

It already had announced the slicing of schedules on certain farm equipment items. Explanation: Dealers have large inventories and unfavorable weather has hurt sales.

• • •

Sales of plumbing goods for domestic and industrial purposes have been only fair this year. Second quarter has been slightly better than the first.

Increase is expected in the third quarter, however. And the final quarter looks good from this distance. The year as a whole will be better than anticipated, thanks to the predicted pick-up later on.

This experience in the plumbing field is contrary to the general trend, which shows a decline the last half of '53.

• • •

Steel demand is of surprisingly large proportions. The production rate stays up at a new peak. Incoming business seems unaffected by the rise in extras. Mills admit, however, that possibility of higher prices may drive in a certain tonnage now rather than later.

• • •

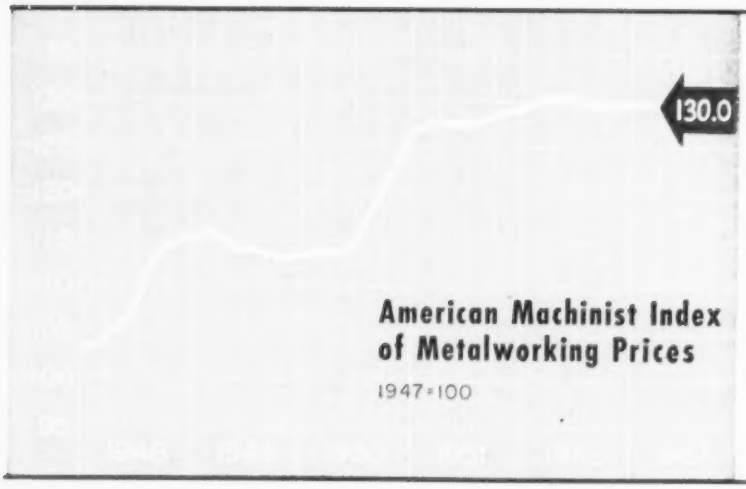
Metalworking business on the West Coast continues very good. Civilian goods are up somewhat. Defense has not suffered much if any.

Airframe builders in southern California expect operations to be pegged at current level or higher the rest of the year, regardless of prospective cuts in Air Force budget.

• • •

Unfilled orders on books of electrical machinery manufacturers were $100 million less in March than in February. Same decline was registered by the machinery industry, whose backlog is $2.2 below a year ago.

Gaging Business



PRICE INDEX

	MAY '53(*)	APR '53(p)	MAR '53(r)	APR '52
Total Index	**130.0**	**129.9**	**129.6**	**129.7**
Metalworking Machinery	**138.9**	**137.9**	**136.6**	
Other Machinery exc. Electrical	**133.7**	**132.8**	**132.5**	
Electrical Machinery	**126.3**	**124.8**	**125.9**	
Fabricated Metal Products	**127.2**	**127.6**	**127.9**	

(*) Estimated (p) preliminary (r) revised

March may have been the peak of the Korean boom. Federal Reserve Board index of industrial production shows the March figure at 243 (1939 =100).

April index was just one point lower. And it looks as if May will be about the same.

• • •

Aluminum production hit a new high in March. Output for the month was 104,460 tons—a 13% gain over the February total and 35% above a year ago. March output topped the previous all-time high set in October 1943 by 11%.

• • •

Freight car builders' backlogs continue to shrink. At the end of April, orders for 62,637 cars were on hand—a decline of 42% from the same period in 1952. April production totaled 6839 cars—8% less than a year ago.

• • •

Steel industry had another 10-million-ton month in May. So far this year, production of steel has run close to or above capacity. About 48.5 million tons of steel have been poured in the first five months of 1953.

• • •

Housing starts in April totaled 110,000 units. The first four months total of 356,100 tops the 352,700 starts for the same period in 1952.

West Coast has shown the greatest housing gains. The January-April period shows building there is 25% ahead of a year ago.

• • •

New labor contracts at General Motors and Ford put a floor under labor costs. Now, even if the cost of living declines as much as 10% in the next few years, automobile workers can get only a 5 cent cut in pay—and this is offset by the annual improvement factor.

April employment was 61.2 million—the largest number of people employed in April at any time in history. Workers numbered 1 million more than in April 1952.

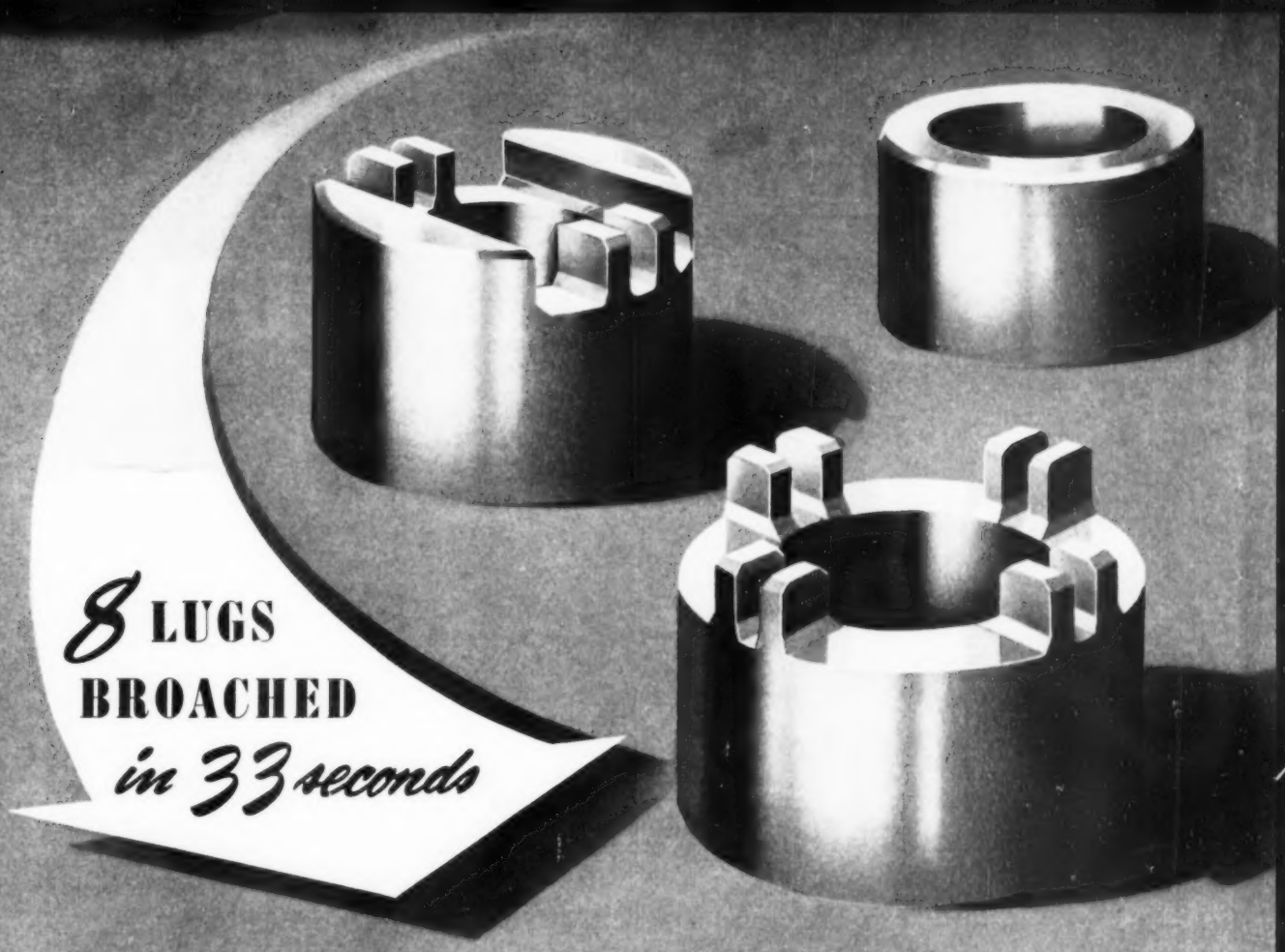
WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1923-1925 = 100)*	258.0	259.7	236.9
Steel ingot operation (thousands of tons)	2,268	2,250	2,091
Electric power output (million Killowatt hours)	8,013	7,959	7,146
Production of automobiles and trucks	162,110	177,305	127,759
Engineering construction awards (*Eng. News-Record*—millions)	$291.3	$257.6	$307.8

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production (1935-1939 = 100)*	242	243	216
Index of durable manufacturers production (1935-1939 = 100)*	327	328	277
Durable goods manufacturers' sales, millions*	$13,035	$13,019	$10,632
Electrical machinery manufacturers' sales, millions*	1,554	1,532	1,059
Other machinery manufacturers' sales, millions*	2,093	2,204	1,970
Durable goods manufacturers' new orders, millions	12,794	13,357	12,171
Electrical machinery manufacturers' new orders, millions	1,252	1,582	1,955
General machinery manufacturers' new orders, millions	1,937	1,813	1,708

* Seasonally adjusted



To produce eight single lugs on the end of a steel sleeve was a problem recently given to Detroit Broach.

After analysis of the operation, Detroit Broach recommended a single ram vertical surface broach to do the job. One of the problems within the job, in addition to increasing output, was the necessity of holding a close tolerance between the lugs.

The vertical broaching machine was set up with a two-station fixture which power-clamps the parts. A single pass of the broach forms four lugs across the sleeve. The sleeve is then indexed 90° and the other four lugs are formed. Complete cycle time—33 seconds per completed part. Slot tolerances are easily held and surface finish on the lugs requires no additional machining.

This is just typical of the specialized broaching techniques evolved by Detroit Broach for leading manufacturers. You, too, may have an application that can be materially reduced in time or cost by the economy of broaching or by review of present broach tooling. It will pay you to consult Detroit Broach for engineering or production data.

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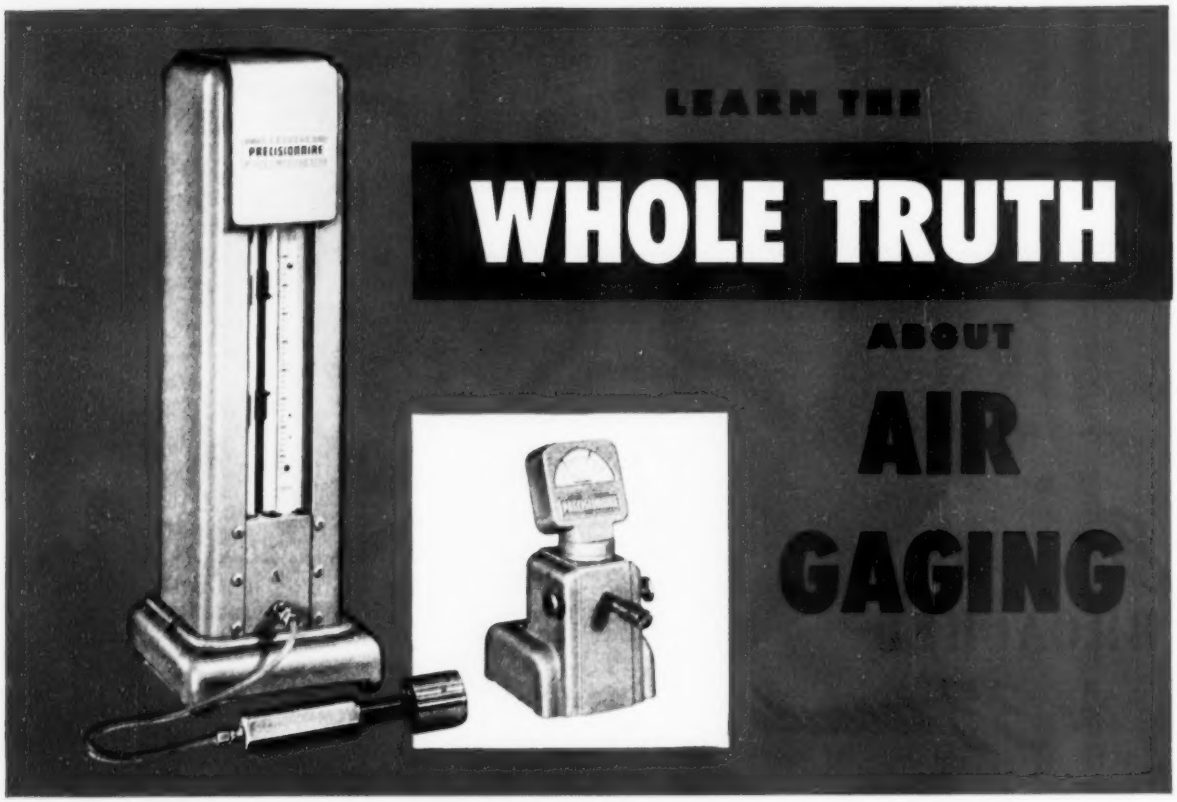

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

New Concept of "Normal"

A new concept of what is "normal" demand for capital goods is in the making. It has special significance for producers and users of capital goods alike.

The new concept puts "normal" at a much higher level than historical experience would lead us to expect. It is the outgrowth of studies made of the capital goods market by the Machinery and Allied Products Institute.

These studies reveal the interesting fact that expenditures for capital goods in recent years have been far above and beyond the projections based on what happened from 1900 to 1930.

THE AMOUNT of money actually spent has surpassed expectations by 15% to 30%. And the expectations were for a healthy increase, to begin with.

What's more, the Institute reports that there is no reason to believe that the large upswing in expenditures is merely an isolated phenomenon that soon will disappear and have no real significance.

The much bigger outlays, which show no signs of returning to lower levels, should be viewed as a new "normal". And for a very practical reason.

The pace of technological advancement has perceptibly quickened since 1940. World War II developments, spurred by the urgency of the situation, speeded it. The keen competition after the war stimulated it. Vast changes, mainly stemming from the Korean war and the defense program, hastened the pace still further.

Enormous growth of our industrial research facilities has helped to accelerate the tempo of change in industrial products themselves and in the equipment for making them.

UNDER SUCH PRESSURE, the rate of obsolescence rises fast. The need for replacing capital goods more frequently and more regularly confronts management.

No longer is it a matter of operating machines until they wear out. They become outmoded—high-cost, inefficient units—long before they cease to do well the job for which they originally were bought.

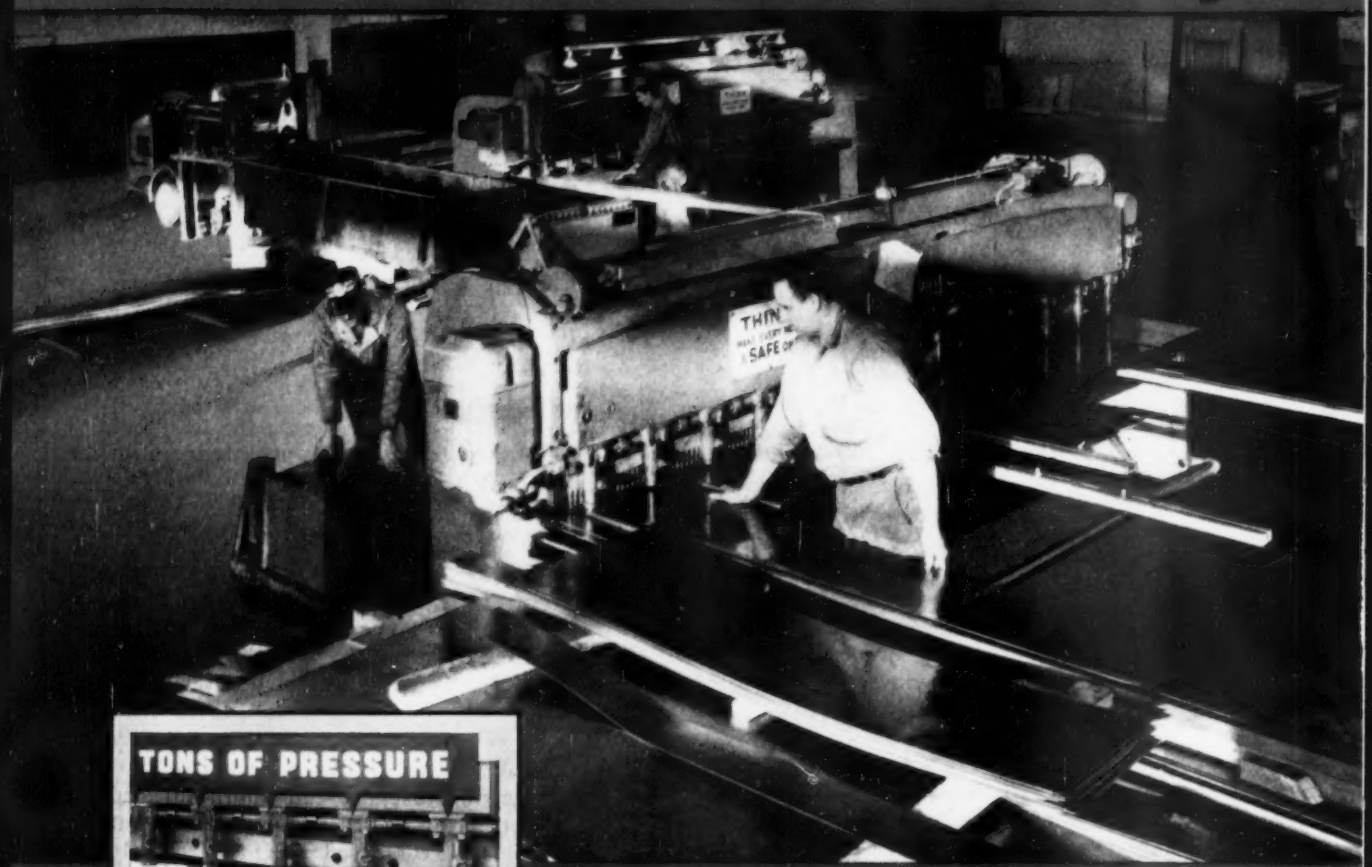
Their owners no longer can afford to keep them on the job. A realistic appraisal of what they are able to do compared with more recently designed machines will reveal all too clearly their inadequacies. Fast-moving changes have left them far behind.

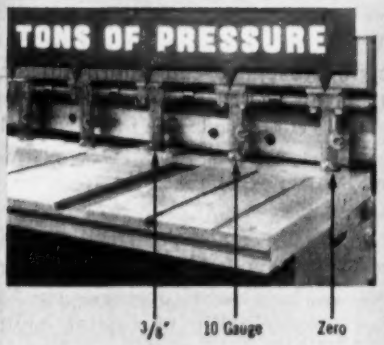
Therein lies the secret of the startling gain in outlay for capital goods beyond normal projected increases. The rate of obsolescence has shortened the economic life of capital equipment.

IT IS TIME to take heed of the Institute's warning that "the administration of equipment policy is the most backward area of management." The best thing you can do, for your own sake, is to make sure that this statement does not apply to you.

Burnham Finney

ACCURACY is necessary





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They handle cold finished, or pickled and oiled sheets up to 10 gauge and hot rolled sheets up to ¼". Both management and operators are enthusiastic about their Cincinnati Shears.

Write for Shear Catalog S-6.

Photos courtesy The W. J. Holliday Company, Inc., Indianapolis, Indiana

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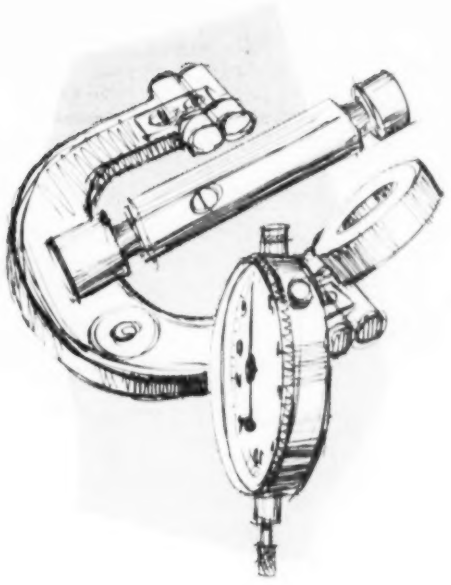


NEW LIMIT SYSTEM PROSPOSED FOR METALWORKING

BY F W M LEE
Managing Director
PILOT PLUG GAUGE CO, LTD
Coventry, England

Standardization of limits into an easily memorized unilateral system would effect tremendous savings in gage costs ... Here is such a system, readily adoptable by Metalworking, that can be put into immediate operation

It has long been apparent that a comprehensive limit system embracing the whole of the metalworking field was required, but it was felt that if a system could be evolved it would be both unwieldy and complicated because of the many aspects it would have to cover.

In developing the system outlined here—the Pilot + 2 system—many other systems were analyzed and superimposed upon one another graphically, to see if they had any common features. There were none; and it became clear that any proposed system must be based upon a new conception in keeping with modern requirements.

What are the Practical Magnitudes of Tolerance Used Today?

This is the first essential question and, to ascertain the tolerances of the metalworking industry, nearly 10,000 limits on gages of recent manufacture produced by The Pilot Plug Gauge Co, Ltd, and John Harris (Tools) Ltd, of Warwick, were analyzed. As a result of this investigation, the original conception of Pilot + 3 was modified to Pilot + 2.

A wealth of information concerning the limits used in many branches of Metalworking was obtained, and from this was designed, a tolerance system constructed upon a number of practical ideals.

IDEAL NO. 1

Unilateral or Bilateral? — There should be little doubt as to the correct choice in this connection. The unilateral system is based on a standard hole, and the diameter of the shaft is varied to give the requisite fit, as opposed to the bilateral system in which the shaft is made to a standard and the hole varied to provide the fit.

In manufacture, it is easier to vary the diameter of a shaft than it is to alter the size of a hole. This decides that the system must be unilateral, as is the case with other dominating tolerance systems.

In the unilateral Pilot + 2 system the smallest diameter of the hole is never less than the basic diameter, and the tolerance is always in a plus direction. That is, the largest diameter to which the hole may be made is greater than the basic size of the hole, by the amount of the tolerance.

IDEAL NO 2

Tolerances Must be Suitable for the Whole Metalworking Field—As already mentioned, nearly 10,000 gage limits were analyzed, and details of this task cannot possibly be shown here. Only inspection of the chart constructed in accordance with Ideal No. 3 will indicate whether tolerances have been provided for any particular product, and it is felt that this ideal has been amply cared for.

IDEAL NO. 3

It Must Be Simple—This means:

a) Any tolerance for any class or diameter of hole can be calculated mentally.

COLOR CODE	CLASS	0 but not 0.126 in.	0.126 but not 1 in.	1 but not 2 in.	2 but not 3 in.	3 but not 4 in.	4 but not 5 in.	5 but not 6 in
	6	6	12	18	24	30	36	42
Black	5	5	10	15	20	25	30	35
Amber	4	4	8	12	16	20	24	28
Blue	3	3	6	9	12	15	18	21
Green	2	2	4	6	8	10	12	14
Red	1	1	2	3	4	5	6	7
	UNIT: Tenths of a thousandth							

TO FIND CLASS—Add 2 to the inch size of the hole, ignoring fractions, and *divide* into the limit. *Example*: What is the class number of a 1-in.-dia hole with a 12-tenths tolerance?

$1 + 2 = 3 \quad \frac{12}{3} = \text{Class } 4$

TO FIND TOLERANCE—Add 2 to the inch size of the hole, ignoring fractions, and *multiply* by the class number. 1 + 2 = 3 x Class 4 = 12 tenths tolerance

FIG. 1 ... PILOT + 2 TOLERANCE SYSTEMS FOR HOLES

b) The table for the smaller range, of which 98.4% of limited holes are below 4 in. in diameter, can be memorized.

c) The fundamental basis of the system can be explained to an apprentice in a few minutes.

The Tolerance Table

The tolerance table, Fig. 1, for classes 1 to 6 and diameters from 0 to 6 in., is arrived at by a simple calculation, insuring that, as the diameter of the hole increases the tolerance also increases, and as the class of the hole becomes progressively coarser the tolerance steps also become coarser.

The table is constructed upon three essentials:

1) The + 2 of the "Pilot + 2."

2) The class or quality of the hole.

3) The diameter.

And the interplay of these three factors insures that the above mentioned requirements are fulfilled.

Calculating the Tolerance

To the inch diameter of the hole add 2, and multiply by the class number of the hole.

A 1-in. dia, Class 2 hole tolerance is therefore: 1 in. dia + 2 = 3 × the Class 2 = 6 tenths.

A 2-in. dia, Class 4 hole tolerance is: 2 in. + 2 = 4 × 4 = 16 tenths tolerance.

A 20-in. dia, Class 2 hole tolerance is: 20 in. + 2 = 22 × 2 = 44 tenths tolerance.

For diameters of 0.125 in. and less, the class number is the tolerance in tenths.

For holes above 0.125 in. and under 1 in. in diameter, the tolerance is obtained thus:

0 + 2 = 2 × the class number = the tolerance in tenths.

Examination of the table shows that for holes:

0 — 0.125 in. . . . tolerance increases with class in steps of 1 tenth.

0.126—0.999 in. . . . tolerance increases with class in steps of 2 tenths.

1—1.999 . . . tolerance increases with class in steps of 3 tenths.

1.999—2.999 in. . . . tolerance increases with class in steps of 4 tenths, and so on.

The table can therefore be memorized, and the method of obtaining the tolerance explained in a matter of minutes.

It will be noted that, apart from the modification of 0.125 in. downwards, which is incorporated for the use of the instrument, watch, clock, and similar trades, the value of the tolerance changes at 1-in. intervals, fractions of an inch being ignored.

IDEAL NO. 4

Total Tolerance Range Must Be Kept to a Practical Minimum—Although only six classes of tolerances are shown in the table, there is no theoretical limitation to the number of classes provided. Industry however has already decided this criterion, for it has been found by investigation that Classes 3, 4, and 5 are the most popular. In one case, Classes 2, 3, and 4 may be stipulated by a manufacturer as suitable for his design, while in another company, with less-exacting requirments, the coarser tolerances of 3, 4, and 5 could be used.

The range must therefore be decided by the individual concerned. In general, a company should specify that certain classes only are to be used. But if a tighter tolerance is considered essential for some particular application, this should be specified only by special permission from the Design and Production Departments. In this way, limits which are unnecessarily tight and have no bearing upon design or production requirements will be avoided and prevented from being perpetuated and increasing production costs.

IDEAL NO. 5

System Must Provide Tolerances for Shafts—The complete layout of the system as applied to shafts is shown in Fig. 2. It will be noted that class tolerance lines exactly similar to the hole tolerance lines above the basic line are provided below the basic line.

These shaft lines are calculated in precisely the same manner in which the hole tolerances were decided, so the tolerance table, Fig. 1, could be literally turned upside down and serve two purposes.

The question of shaft tolerances is considered below.

IDEAL NO. 6

System Should Give a Mental Picture of Fits—Here it is well to recall that this is a unilateral system, in which the smallest diameter of the hole—subject to qualification later—is never less than the basic diameter.

In any fit, the smallest diameter of the hole is the dominating dimension, so it is the nominal or basic diameter of the hole which must be kept in mind when deciding a fit.

Running Fit.

Assume a 1-in.-dia hole has been produced to its smallest size of exactly 1 in., and a shaft is required to run in this hole with a minimum clearance of three tenths, and a maximum clearance of six tenths. Reference to the class lines below the basic line for 1-in. indi-

cates that this particular shaft can be described by the figures 1 and 2, of which 1 is 3 tenths below the nominal line, and 2 is 6 tenths below. In this system the nominal line is indicated by an oblique stroke, and as the shaft of a running fit is smaller than the smallest or nominal size of the hole, the class number controlling the size of the shaft would be placed to the right, or minus side of it, thus, /12.

Because the largest diameter of the hole is controlled by the class number or, in other words, by the tolerance, the hole is then perfectly described in the case of a Class 1 hole by 10/. The zero is the nominal size, irrespective of class or diameter, from which it follows that only one number, the class number, is required to describe the hole, as the other number is always zero and can be ignored.

The running fit can now be written 1/12, of which the first 1 is the Class 1 hole, and the 12 a shaft which is a minimum of 3 tenths, and a maximum of 6 tenths smaller than the nominal size, and therefore has the desired clearance.

Interference Fits

In a similar manner, an interference fit would be written 123/ in which, by usage, the first number is the Class 1 hole and 23 the shaft. In this case, the shaft is to the left or plus side of the nominal line, which means it is bigger than the hole, because the class numbers controlling its size are numerically greater than the class number of the hole.

Selective Assembly

By the same reasoning, a selective assembly fit is written 110/, from which it is apparent that the hole and the shaft have the same tolerances and must therefore be mated.

The fit of the hole described in the above manner should be incorporated in the assembly or subassembly drawing, and the actual tolerances stated on the component drawing.

IDEAL NO. 7

Provision for Ball & Roller Race Housing Tolerances. — Ball and roller race housings require three types of holes: oversize, transition or bilateral, and undersize holes.

The Pilot + 2 system, being essentially unilateral, would not be complete if it could not provide suitable tolerances for ball-race housings.

Before proceeding it is necessary to define the above types of holes:

Oversize: The maximum permissible diameter and the minimum diameter of the hole are both larger than the nominal size of the ball race to be used in it.

Bilateral: The maximum size is greater and the minimum size less than the nominal diameter of the ball race.

Undersize: Both diameters are smaller than the nominal outside diameter of the ball race.

With an oversize hole, the smallest diameter of the hole is larger than the basic diameter, and therefore zero, or 0, will not describe the minimum diameter. A number, which is the class number, is used to say how much the smallest diameter is larger than the basic diameter, and therefore an oversize hole requires two numbers to define it. Because two numbers are used to describe a shaft, a prefix B, for bearing, is used to designate a bearing hole. For example:

It is required to describe a bearing hole for 1½-in.-OD ball bearing with an easy sliding fit of + 24 tenths top limit, and + 12 tenths bottom limit. From memory, this will be a Class 8 and Class 4; or, by calculation, 24 divided by 3 = 8, 12 divided by 3 = 4. Because both are plus, and therefore to the left of the oblique stroke, the bearing hole would be described accurately by B 8.4/.

In a similar manner a bilateral hole could be described by B 2/1, and an undersize hole by B/ 1.4.

One of the salient features of the Pilot + 2 system is the mental picture conveyed by the position of the class numbers relative to the

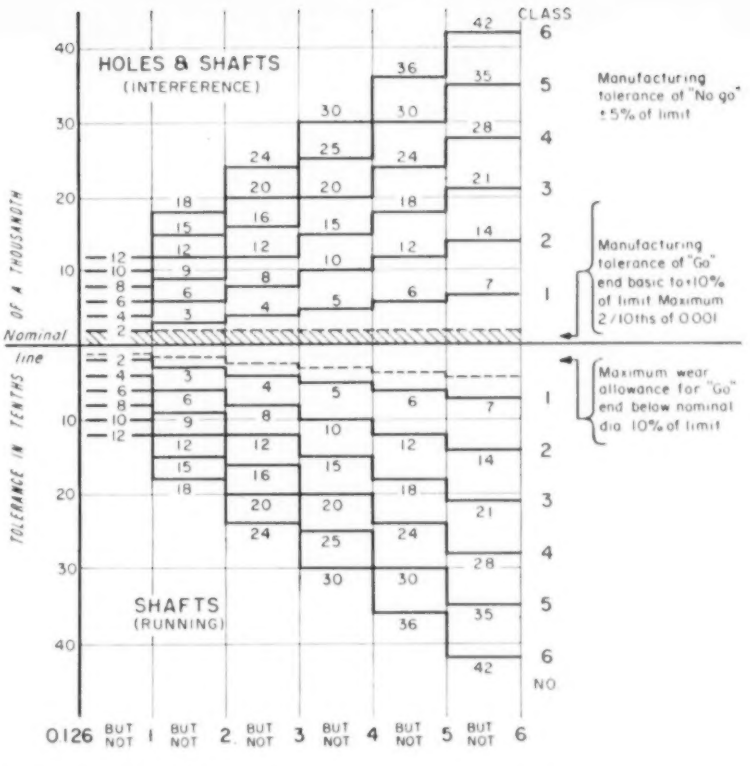

HOLES & SHAFTS
(INTERFERENCE)
SHAFTS
(RUNNING)
CLASS
Manufacturing tolerance of "No go" ±5% of limit
Manufacturing tolerance of "Go" end basic to+10% of limit Maximum 2/10ths of 0.001
Maximum wear allowance for "Go" end below nominal dia. 10% of limit
TOLERANCE IN TENTHS OF A THOUSANDTH
Nominal line
0126 BUT NOT 1 BUT NOT 2 BUT NOT 3 BUT NOT 4 BUT NOT 5 BUT NOT 6
NO
See chart for "0 but not 0.126 in."
Tolerance = (Inch Dia + 2) × Class No.
Class No. = Tolerance / Inch Dia + 2
Ignore fractions

FIG. 2 . . . PILOT + 2 LIMIT SYSTEM FOR HOLES AND SHAFTS

AMERICAN

ABOVE	0.029	0.825	1.510	2.510	4.510
TO & INCLUDING	0.829	1.510	2.510	4.510	6.510
Z	10	12	16	20	25
Y	7	9	12	15	19
X	4	6	8	10	13
XX	2	3	4	5	6.5

UNIT: Tenths of a thousandth

PILOT + 2

CLASS	0.126 but not 1 in.	1 but not 2 in.	2 but not 3 in.	3 but not 4 in.	4 but not 5 in.
4	8	12	16	20	24
3	6	9	12	15	18
2	4	6	8	10	12
1	2	3	4	5	6

UNIT: Tenths of a thousandth

FIG. 3 . . . AMERICAN TOLERANCE TABLE constructed upon gage catalog information. Note similarity of tolerance values

oblique stroke or basic line, indicating in which of the three categories the hole belongs. And by the magnitude of these numbers it shows immediately the type of fit between bearing and housing.

IDEAL NO. 8

Manufacturing Tolerances for Gages Must Be Stated.—The usual practice of allowing the gage maker 10% of the limit as a manufacturing tolerance in a positive direction on the GO end is adopted, and that the 10% manufacturing tolerance should be split on the NO GO end is shown in the following example: The gage to be made is nominally 1 in. in diameter with 10 tenths limit. As 10% of the tolerance can be allowed in the manufacture of the GO end, and as this is used in a positive direction, the GO end can be to a minimum size of exactly 1 in. and a maximum size of 1 in. plus one tenth.

Gage manufacturers regularly make the gage to the 1-in., plus one-tenth, or top-limit diameter, to provide maximum wear allowance.

Turning to the NO GO end, the manufacturing tolerance is split, that is, the NO GO end may be 5% of the limit larger than its theoretical size of 1 in. plus one thousandth, or smaller than this size by 5% of the limit.

Here again, manufacturers try to keep the gage up to the top limit, or greatest permissible size, to insure that Production has the greatest possible tolerance.

Shop and Inspection Gages

No mention has been made of Shop and Inspection gage tolerances, because they are considered to be correct in theory, but impossible in practice. A small excursion will make this clear:

A new Shop GO end is slightly larger than its Inspection counterpart but, because of the more severe conditions under which the Shop gage is used, wear is more rapid, so it becomes smaller than the Inspection gage in a short time, thus completely reversing this consideration. It may be argued, theoretically, that frequent inspection of gages will prevent this, but in practice it must be admitted that such an ideal state is seldom, if ever, attained. With this in mind, and the fact that sharing the tolerance between Inspection and Shop robs the operator of much needed assistance, the Pilot + 2 system employs only one manufacturing tolerance.

In the chart, Fig. 2, it will also be noted that the maximum manufacturing tolerance has been confined to two tenths. This will be referred to below.

IDEAL NO. 9

Wear Allowance of GO End Must Be Defined—Established practice will be employed; that is, the GO end, the wearable member, should be allowed to wear a maximum of 10% below basic size before withdrawal from service. For example:

A 1-in. Class 1 gage has a limit of 3 tenths, and 10% of 3 tenths is 30 millionths. The GO end would therefore be allowed to wear 30 millionths under size, or below basic diameter, before withdrawal from use. As a certain amount of clearance between gage and hole is required under production conditions, it might justly be claimed that the hole will be, to all intents and purposes to size.

In the case of a 1-in.-dia gage with a 10 tenths limit, the GO end would be allowed to wear one tenth below the basic diameter of exactly 1 in. This method is widely adopted in the metalworking industry.

IDEAL NO. 10

Tolerance Systems Must Cater to American Limits—If this ideal can be fulfilled, two important requirements are met: 1) Interchangeability is unaffected, 2) American gages are not scrapped.

In American gage catalogs, particulars are given of the manufacturing tolerances for gages made to different grades of accuracy, designated XX, X, Y, and Z. As the practice of allowing 10% of the limit in a plus direction on the GO end as a manufacturing tolerance and ± 5% of the limit on the NO GO end is adopted, as in the Pilot + 2 system, a tolerance table can be constructed (Fig. 3).

DIAMETER STEPS		U.S.A. XX	PILOT +2			U.S.A. X	PILOT +2			U.S.A. Y	PILOT +2			U.S.A. Z	PILOT +2		
PILOT +2	U.S.A.	TOL.	TOL.	CLASS	DIFFERENCE	TOL.	TOL.	CLASS	DIFFERENCE	TOL.	TOL.	CLASS	DIFFERENCE	TOL.	TOL.	CLASS	DIFFERENCE
	0.029																
0.125		2	2	2	0	4	4	4	0	7	7	7	0	10	10	10	0
	0.825	2	2	1	0	4	4	2	0	7	6	3	−1	10	10	5	0
0.999		3	2	1	−1	6	6	3	0	9	8	4	−1	12	12	6	0
	1.510	3	3	1	0	6	6	2	0	9	9	3	0	12	12	4	0
1.99		4	3	1	−1	8	9	3	+1	12	12	4	0	16	15	5	−1
	2.510	4	4	1	0	8	8	2	0	12	12	3	0	16	16	4	0
2.99		5	4	1	−1	10	8	2	−2	15	16	4	+1	20	20	5	0
3.99		5	5	1	0	10	10	2	0	15	15	3	0	20	20	4	0

FIG. 4 . . . EQUIVALENTS CHART OF AMERICAN AND PILOT + 2 TOLERANCE SYSTEMS Note that exact equivalents exist in the majority of cases and where differences occur they are of no practical importance with the exception of two cases in the XX grade. See text UNIT 1/10 thousandth minus sign indicates pilot + 2 tolerance is so many tenths "tighter"

Below the American tolerance table is placed the Pilot + 2 system. Note the remarkable resemblance in the tolerance values.

Further inquiry indicates, however, that the diameter steps at which the tolerance changes take place in the two systems are at variance, but this does not present a problem of practical magnitude, as will be shown in an article to be published at a later date.

The similarities of the two systems as they now exist are so definite that this is of interest:

XX GRADE

Exact equivalents Pilot + 2	71%
One tenth difference	28%

X GRADE

Exact equivalents Pilot + 2	75.3%
One tenth difference	12.3%
Two tenths difference	12.4%

Y GRADE

Exact equivalents Pilot + 2	63.2%
One tenth difference	36.8%

Z GRADE

Exact equivalents Pilot + 2	87.6%
One tenth difference	12.4%

The percentages given are for holes 4 in. in diameter and less which, by investigation, comprise at least 98.4% of all limited holes.

Exact equivalents for American tolerances are found in the Pilot + 2 system to a very high degree, as will be seen in Fig. 4. In the few cases where differences do arise, their magnitude is small when compared with the total tolerances employed, and of no practical significance. The exception is the three instances in the XX Class which will be the subject of a detailed analysis in the next article.

The Replacement tables, Fig. 5, detail Pilot + 2 equivalents for American and BSI "U" tolerances, from which it will be rightly assumed that the Pilot + 2 system supplies the important and desirable connection between American and British practice.

IDEAL NO. 11

System Should Reduce Gage Stocks—Reference has already been made to an upper manufacturing limit of two tenths on the GO end and, to conserve space, the user's point of view only will be considered.

AMERICAN						BSI "U"		
ABOVE	To and including	PILOT +2 CLASSES FOR				FROM	TO	PILOT +2 CLASS
		XX	X	Y	Z			
0.029	0.125	2	4	7	10	0	0.125	6
0.125	0.825	1	2	3	5	0.126	0.290	3
0.825	0.999	1	3	4	6	0.300	0.590	4
0.999	1.510	1	2	3	4	0.600	0.999	5
1.510	1.999	1	3	4	5	1.000	1.490	4
1.999	2.510	1	2	3	4	1.500	1.999	5
2.510	2.999	1	2	4	5	2.000	3.999	4
2.999	3.999	1	2	3	4			

At least 98.4% of limited holes are below 4 in. in dia.

FIG. 5 ... REPLACEMENT TABLES
Note that there are extra change steps introduced between the published diameters given in American and BSI "U" tables because the Pilot + 2 class tolerances change at different diametrical intervals to British or US practice

A gage with a 5 thousandths limit, under the 10% rule, could have a maximum of 5 tenths, wear allowance or, in other words, it could be this amount larger than nominal size.

Again, under the 10% rule applying to the amount the gage can be allowed to wear below the basic size, another 5 tenths is available for increasing gage life, or a total of 1 thousandth which, by all standards of reasonableness, is too great.

It will therefore be seen that if the maximum wear allowance above basic size is confined to 2 tenths, then such a GO gage end will be suitable for any class of hole whose limit is 2, 3, 4 thousandths, or larger.

This limitation reduces the cost of the gaging system, for it will be apparent that, in the ideal situation, when the GO and NO GO gages are separate, as in larger sizes, one GO end can be used for any hole with a tolerance of 2 thousandths and above, and a series of NO GO gages only will be required to control the maximum size of the hole.

IDEAL NO. 12

Color Code Aids Identification—Reference to Fig. 1 indicates that Red is used for Class 1 gages; Green, Class 2; Blue, Class 3; Amber, Class 4; and Black, Class 5 and above.

This is carried into effect by using colored anodized aluminum handles which insure that the gages are recognized instantly in use and in storage.

IDEAL NO. 13

System Reduces Scrap by Preventing Reamers From Cutting Oversize—It is well known that a new, sharp reamer cuts big. Assume that the hole is ½ in. in diameter and has been cut 8 tenths oversize or, in other words, a Class 4 hole.

Under the color code, Class 4 is amber; it follows that, by painting the reamer amber between the top of the flutes and the shank, or slipping on a colored synthetic rubber band, the reamer is immediately labeled as one cutting an 8-tenths oversize hole.

As the reamer wears and the hole becomes progressively smaller, the color is changed at the various tolerance grades until red finally appears, making it the most valuable reamer in the shop. In this way reamer life will be increased and scrap avoided.

Tips

FOR TOP SHOP MEN

459 If you want a rule kept, pick the worst violator to police it. When he has the problem licked in his own behavior, it's easy to lick it in others—and it will help lick *his* next problem.

460 It's all right to be a good fellow, if you also remember to be a good boss. The latter means taking a stand when a stand must be taken. Otherwise the willing worker gets overloaded, while the unwilling one soldiers on the job.

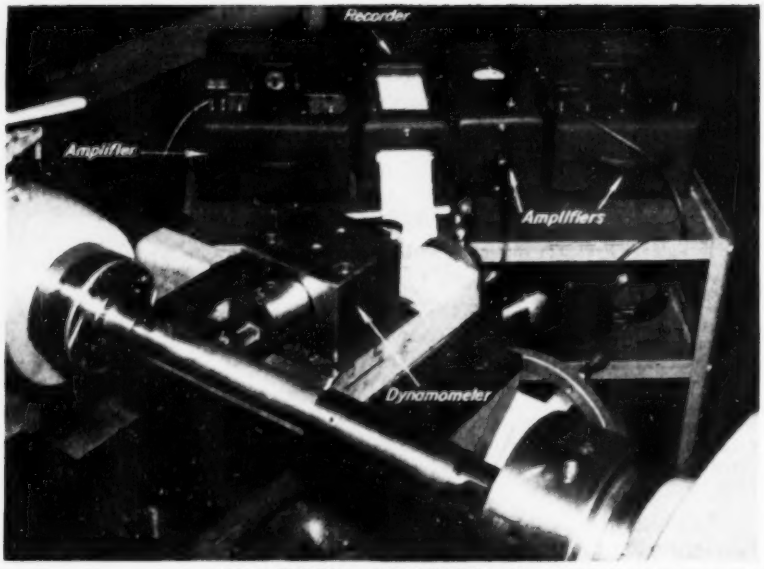


FIG. 1—TOOLPOST DYNAMOMETER is fitted with SR-4 strain gages to detect cutting and feed forces. The minute electromotive forces developed by the strain gages are amplified and fed into a tape recorder

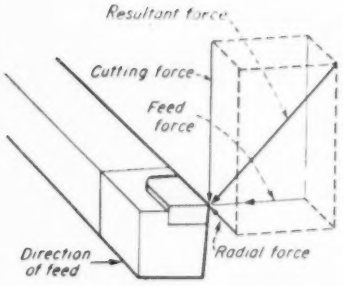


FIG. 2—THREE FORCES act upon the tool tip. Their relative magnitude influences chatter and vibration, tool wear, and possible destruction of the carbide

Practical approach to optimum machining..II

FORCES AND VIBRATION ON THE TOOL AFFECT ITS LIFE

Vibration is never good, especially on carbide. And tool wear changes the relationship of forces acting on the tool and increases the vibration. So, if you want maximum service per grind, change tools at proper intervals and grind them correctly

BY A B ALBRECHT, Metallurgical Engineer, MONARCH MACHINE TOOL CO

Evaluation of cutting forces under operating conditions provides the fundamental approach to successful design of today's machine tools. Before we can establish any basis for design features, we must first evaluate the effect of impact, vibration, cutting forces and temperature on individual components of the machine. Sturdy and accurate oscillographs are available for recording static and transient data during a cutting test.

Experimental tests involve measurements of the static force at the tool tip, and determining the peak-to-peak displacement and frequency of vibration induced by the cutting action. If work material and tooling are properly controlled, reproducibility of individual results within 3% is easily obtained. Then, actual force data can be applied to mathematical analysis of the cutting strain, the heat produced by shear action, power requirements, and unit stresses on the machine parts. The relationship between tool-forces and surface speed is typical of the practical data obtained from this type of research.

Force measurements are conveniently obtained by using a strain-gage dynamometer. The dynamometer that we use has four SR-4 strain gages. These are cemented to a cantilever that holds a standard ¾-in. AR-12 tool. The gages, along with dummy gages used for temperature compensation, form two Wheatstone bridges. These measure forces in both the vertical and horizontal directions. The unit is calibrated by balancing the bridge and applying a static load to the tool tip. The dynamometer, amplifier and oscillograph are shown in Fig. 1.

In forming a chip, the shear process (discussed in the first article) produces three active forces on the cutting edge of the tool. These forces and their re-

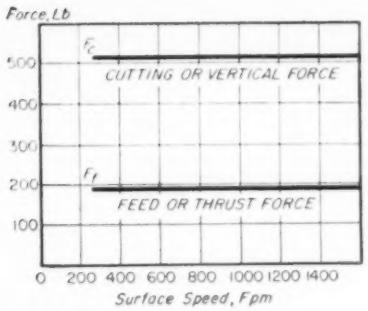


FIG. 3—CUTTING and feed forces for a specific setup remain virtually constant over a wide range of surface speed. The feed or thrust force is always lower; in this case being 40% of the cutting force. Material: AISI 4145; 0.010 ipr

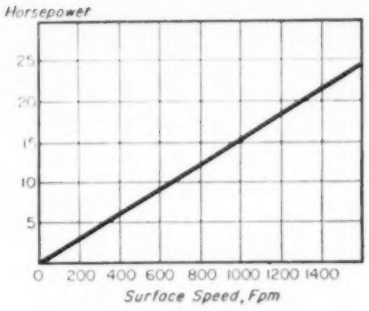


FIG. 4—HORSEPOWER per cu in. of metal removal increases directly with cutting speed. This accounts for the large amounts of power required for high-velocity turning

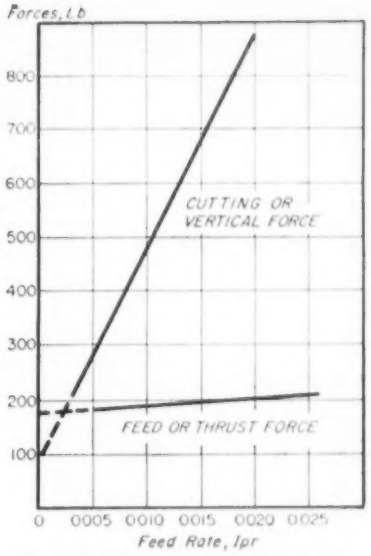


FIG. 5—RATIO of cutting force to feed force F_f/F_c varies with the feed rate, since the cutting force increases sharply and the feed force is relatively constant. The intersection of the curves indicates instability at low feed rates. Material: AISI 4145; 720 fpm; 0.150 in. depth of cut

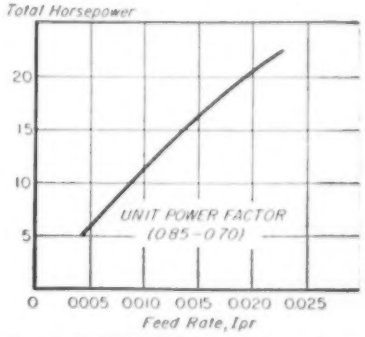


FIG. 6—HORSEPOWER is not a linear function of feed rate, as it is of speed. The power factor decreases from 0.85 to 0.70 hp per cu in. of metal removed as feed is increased. Material: AISI 4145; 720 fpm, 0.150 in. depth of cut

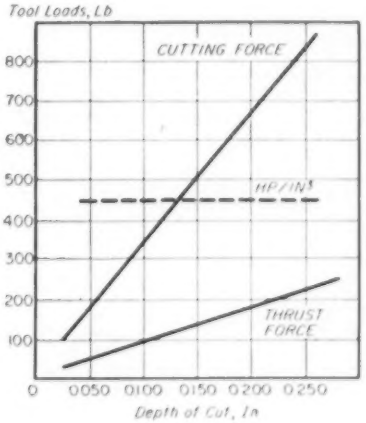


FIG. 7—AN INCREASE IN DEPTH of cut produces proportional increases in the feed and cutting forces, but the unit horsepower per cu in. of metal removed remains constant. The ratio F_f/F_c remains constant with depth of cut. Material: AISI 4145; 710 fpm; 0.010 ipr

lationship to the tool tip are shown in Fig 2. The vertical force, which is the horsepower component, acts upon the top surface of the tool and represents the energy required to produce internal shear. The thrust, or feed, force acts upon the flank edge of the tool and its magnitude is determined by the energy required to feed the tool into the work. Its value is normally about half that of the cutting force, but varies with feed rate and degree of tool wear. This force actually requires only a small percentage of the total power. The third force component produces a radial force back along the tool shank. This force is a result of the elastic deformation of the work surface during the cut, and normally has a very low value, with the exception of a few individual machining conditions.

Force data in Fig. 3 show the effect of increasing surface speed on the vertical and horizontal forces. At lower speeds the tool forces are influenced by the presence of a built-up edge. With increasing speed there is a *slight* decrease in tool forces. A decrease rather than an increase is produced because, as surface speed is increased, higher tool temperatures reduce the tendency for pressure welding, and produce a more constant force. Thus, at higher cutting speeds, (above 400 fpm), the force remains nearly constant. However, the chip thickness decreases, causing an increase in the unit shear value. At the same time, the unit force on the tool surface increases and may approach the transverse rupture strength of the tool. This result accounts for the shock sensitivity of carbides when turning at high speeds.

A heavier feed rate raises the level of the forces acting on the tool, but the general form and shape of the curves in Fig. 3 are retained.

The chip ratio remains constant above 450 sfpm, indicating that the primary shear action is not influenced by higher machining speeds. There is no substantial reduction in the unit power required to remove metal with increasing surface speed. Actually there is a linear increase in the total power requirements with speed, as shown in Fig. 4.

By using values from these curves, the unit shear stress and strain rate may be calculated. These basic factors are of interest when evaluating the machinability of steels, and help to show the high amount of energy required in a cutting operation.

In production turning, the tool forces are affected by many machining factors, and never remain constant during the entire life of the tool. As the tool wears, the feed and radial forces increase, thus changing the direction of the resultant force on the tool tip. The

cutting force is less sensitive to tool wear. Dull tools always develop a high compressive stress on the tool edge, often exceeding the transverse rupture strength of the carbide.

Changes in rake angles from poor grinding will also effect tool forces. As the side rake angle is increased, lower forces are obtained but the strength of the tool is reduced. Chip breakers, uneven depths of cut, and intermittent cuts all produce fluctuations in force values. If these fluctuations are severe enough, they can cause chipping and breakage of the cutting edge prior to normal tool wear. If such conditions are expected, it is advisable to use carbide tools that have a higher percentage of cobalt, and to hone the cutting edge to a negative 4° rake to further support the cutting edge.

Cutting Force Changes

The effect of increasing the feed on the tool forces is shown in Fig. 5. Note that the thrust force is little affected by the feed and that the major change in force occurs in the cutting force. As the feed rate is increased, a thicker chip is produced and a larger shear plane is obtained. The net result is an increase in the cutting force and a reduction in the unit energy required to form a chip (resistance of metal to shear is derived by dividing the force by the cross-sectional area of the chip). The effect of this on the power requirements is shown in Fig. 6. From this curve, it is clear that increased feed rate produces a more economical cutting condition from the standpoint of power. It is well to remember that there is a definite limit to the feed that may be used and still maintain a balanced force system at the tool tip free from impact.

Heavier depths of cut result in a larger area of shear. This in turn causes a steady increase in the cutting forces produced by the cutting operation. The effect of depth of cut on the vertical force is shown in Fig. 7. The unit energy required to remove metal remains the same, indicating that the shear action is not effected by the depth of cut.

The net resultant obtained from the force pattern for any given cut influences the rate of tool wear, the vibration pattern produced at the tool edge, and the stresses on machine parts. Abnormal cuts, roughing cuts that produce exceptionally high cutting forces, and the machining of work with a poor length-to-diameter ratio will produce an unbalanced force system. The result will be excessive tool wear and chatter.

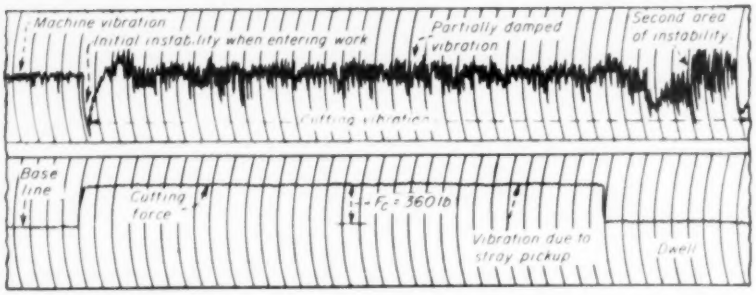


FIG. 8—TAPE RECORDING of forces indicates that instability may occur when the tool enters the work and if it is allowed to dwell at the end of the cut. The initial instability may readily be great enough to cause tool breakage. Test conditions: 790 fpm, 15 in. per min. feed, 0.100 in. depth of cut

Our machinability tests convince us that there is an ideal force distribution for every cutting operation. A high cutting force will increase the pressure of the chip on the tool surface, accelerating the rate of wear. Chatter conditions are obtained when the radial or thrust force approaches the value of the cutting force.

The tape recording in Fig. 8 shows a force and vibration trace from a machining cut made at 790 sfpm, using 15-in. per min. feed. Tests such as these help us to locate points of instability in a cutting operation. It will be seen that as the tool engages the work, there is great instability in the system, and that the amplitude of vibration is very high. As cutting continues, this self-induced vibration is slightly damped, and the tool continues to vibrate at a frequency somewhere close to the natural frequency of the system. At the end of the cut, if the tool is allowed to dwell, another severe vibration pattern is obtained.

If the cutting force is low, as when starting into a cut, conditions favor self-induced vibrations. In each case where a poor vibration pattern was obtained, when machining this 2-in. bar of 8640 steel at 1500 rpm, there was an

FORCE AND HORSEPOWER DATA FOR VARIOUS SPEEDS, FEEDS, AND DEPTHS OF CUT

Material	Rpm	Dia	Sfpm	Feed	Depth	F_c	F_r	Hp	Removal Rate, Cu In.
	310	2½	465	0.010	0.150	423	93	5.9	8.3
AISI-1141	440	2½	670	0.010	0.150	426	76	8.6	12.0
207 Bhn	620	2½	930	0.010	0.150	450	63	12.6	16.7
	1800	2½	1230	0.010	0.150	426	63	15.8	22.2
	1750	2	740	0.006	0.150	330	147	7.4	8.0
AISI-4145	1750	2	740	0.011	0.150	540	156	12.1	14.6
207 Bhn	1000	2½	580	0.010	0.020	696	240	12.2	13.6
C-1117	436	3½	400	0.011	0.150	510	200	6.1	6.6
110 Bhn	436	3¼	400	0.022	0.150	830	240	10.0	15.9
	1000	2½	580	0.010	0.050	204	60	3.6	3.4
AISI-4145	1000	2½	580	0.010	0.010	366	120	6.4	6.8
207 Bhn	1000	2½	580	0.010	0.020	696	240	12.2	13.6
AISI-8640	700	3	560	0.015	0.250	1190	560	17.1	25
197 Bhn	570	3	450	0.010	0.200	710	300	9.7	10.7

unbalance in the force system. At such times the radial and thrust forces approached the value of the cutting force.

Vibration at the tool tip during a cut is detected with a crystal pickup connected to a Brush amplifier, a simple device. Force measurements are made along with vibration tests in an effort to determine the nature of the instability in the force system which caused the vibration. It has been found that self-induced vibrations are likely to occur when: (1) turning at high speeds, (2) at the time the tool engages the work, (3) when machining with dull tools, and (4) in all cases when high radial and thrust forces are obtained. Examples of chatter conditions produced by these factors have been given. Also see Fig. 9. Tool wear is indicated by the steady increase in the feed force. Carbides are sensitive to the fluctuations in stress caused by the amplitude and velocity of the vibration, and the end result is destruction of the carbide tool. Sensitivity of carbides to vibration appears to increase at the higher cutting speeds, which makes it important to check the rigidity of the machine tool before contemplating changing to a higher surface speed.

Tool-Life Testing

Force measurements have also been used successfully for tool-life testing. Breakdown of the tool is established by observing the point at which the feed and radial forces start to increase rapidly. In an effort to reduce the time required for the tests, high surface speeds are used. Fig. 10 shows a tape in which the tool has been rapidly worn down at high surface speeds.

To summarize the effect of variable speed, feed, the depth of cut on tool forces, the accompanying table has been prepared. All values are from recorded tapes made from machining tests performed on our Mona-Matic high-speed test lathe. The general trend shown in the plotted data is duplicated in this table. The cutting force holds constant with speed, but varies greatly with depth of cut and feed.

Part III of "Practical Approach to Optimum Machining" will appear in an early number.

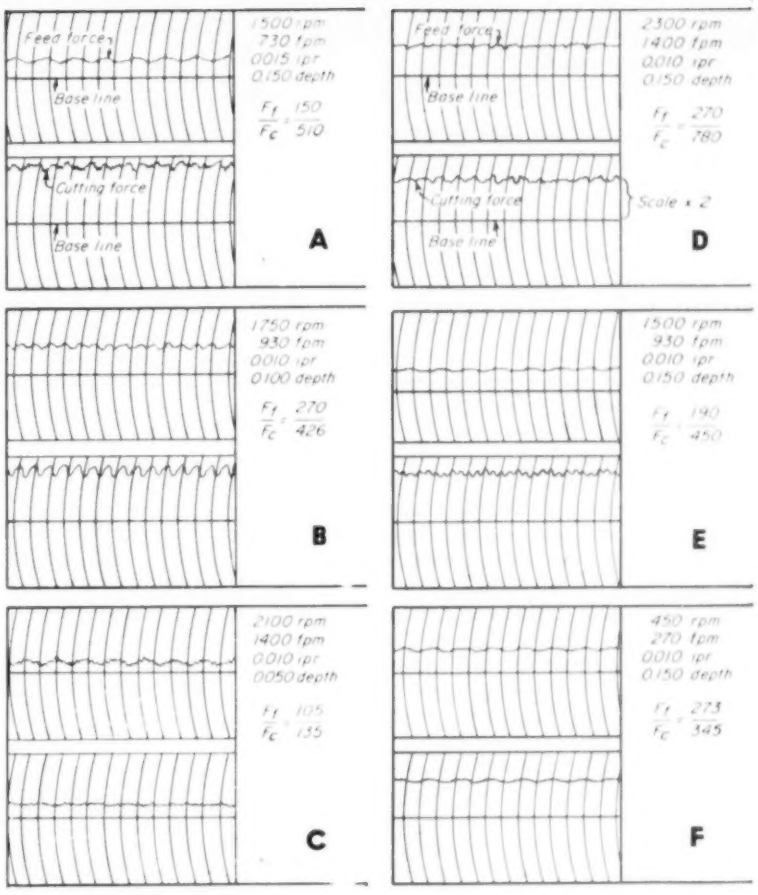


FIG. 9—THESE FORCE TRACES illustrate various conditions that produce chatter: (*A*) poor clearance angles and large nose radius; (*B*) Intermittent cut, load on tool varied ± 75 lb; (*C*) Unbalanced force system from low cutting force due to light cut; (*D*) Dull tool caused high cutting force and build up of feed force; (*E*) An overbroken chip, and (*F*) Unbalanced force system; frequency of vibration low due to low surface speed. In each case, a chip was obtained with uniform fracture marks on the inside. Further, in each case the top trace is the feed force; the lower trace is the cutting force; pen deflection is approximately 30 lb per unit, and the straight lines are the base lines

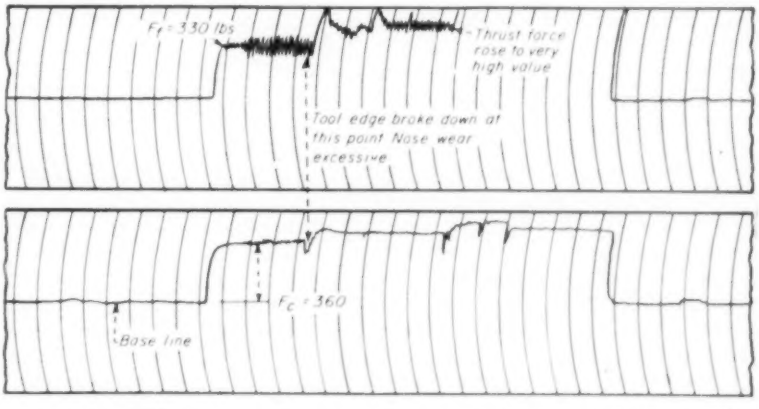


FIG. 10—TOOL FORCES increase rapidly when turning at high speed with worn tools. Destruction test was started with tool having 0.030 in. flank wear. At this point, feed force F_f begins to approach cutting force F_c, producing noticeable chatter. Material: AISI 1141; 1500 rpm; 910 fpm; 17 in. per min. feed; and 0.150 in. depth of cut

- ***encourage long service...***
- ***catalog abilities...***
- ***train for specific needs...***
- ***know your talent inventory...***
- ***promote from within, through***

EMPLOYEE PROFILE

In the span of a few years, the number of employees at The Allen B DuMont Laboratories, Inc, increased from a small and intimate group to a force numbering more than 6000 people in five manufacturing plants, plus the people employed in the television network operation. The company's policy is to hire for jobs at the bottom of the ladder and then promote, rather than to bring in outsiders for top-level jobs. As the company underwent this rapid expansion, it became apparent to Industrial Relations Director Harry Housten that changes in personnel methods were needed to preserve the standards of fair and impartial treatment of employees. As the many new responsibilities developed, the openings were boldly filled by promotion from within. Then it was quickly seen that this practice, without fully evaluating the person, was very dangerous. A good worker does not always make a good supervisor.

Thus, the next step was to organize and develop a series of supervisory training conferences. Planned discussions were built around the company's own problems and supplemented by sound films. *Attendance was mandatory* for all except president and vice-president. This was during WWII. Rapid expansion made it necessary to entrust policy to many people. Abilities were in great demand. Ideals could easily fall by the wayside. The company determined that there should be no compromise with principle, but had no idea of how to avoid compromise and still fulfill its obligations. Hence, the conferences were organized to find a sound program; also to provide an immediate training source for supervisory employees.

Development of a "patterned interview" application blank was the next step, to insure more uniform screening. This form was designed to simplify obtaining and recording the many details about each applicants' education, training, previous experience, ambitions, interests, hobbies, and other personal items and qualifications. As a record and for use in future evaluations, all employees were asked to fill out this new form. Of course, no downward adjustments were made as a result of this new knowledge. It was used simply to provide a complete working base.

Improvement was quickly apparent under this new system, but it also showed considerable weakness in the upgrading procedure. Thus, the third step was to work out a merit-rating procedure whereby every employee was periodically rated and his progress accordingly directed.

With these two questionnaires providing a thorough picture of the *experience* and *capability* of each employee, only one phase was missing. What was the *knowledge potential* of this person? Some form of testing procedure was desirable at the screening interview. The so-called IQ tests were becoming popular, so the IQ was added but, for the first year, was given no weight in decisions. During this period, as the merit rating sheets accumulated, studies of the original application form, the IQ, and the merit rating were made until a pattern was seen to develop. Merit rating provided a secondary factor too, a guide to the supervisor's ability to evaluate his own personnel.

now for the experts!

With WWII over and the usual conversion headaches out of the way, expansion continued at a greater pace than ever. The company, through '48, '49, and '50 began to scrape the bottom of the manpower barrel. By this time a corps of interviewers were desperately screening applicants to fill the ever-increasing demand. The company was faced with a terrific absentee and turn-over problem. Why? Having heard of the excellent work done by Rensselaer Polytechnic Institute in veteran screening and placement, the company decided that the time was ripe to call in the experts.

Next on the agenda, with the help of RPI, the company built a battery of aptitude and personality tests. To validate these tests, volunteers from within the organization were asked to take the tests. Meanwhile RPI specialists studied the entire program and made many recommendations.

Turn-over was the most urgent problem so the company prepared a survey letter to be sent to all of the people who had been tested, hired, and had left. The letter was mailed from RPI. It stated the purpose of the testing and asked for a frank statement of the reason for leaving. It further assured the people surveyed that their names would remain confidential with RPI. Returns were excellent and a large majority expressed the same reason: New employees were worried about their ability to attain DuMont standards within the short period of training given in the factory. As a result, the training department of the Industrial Relations Division developed a new program designed to eliminate this worry and to strengthen the employee's feeling of security.

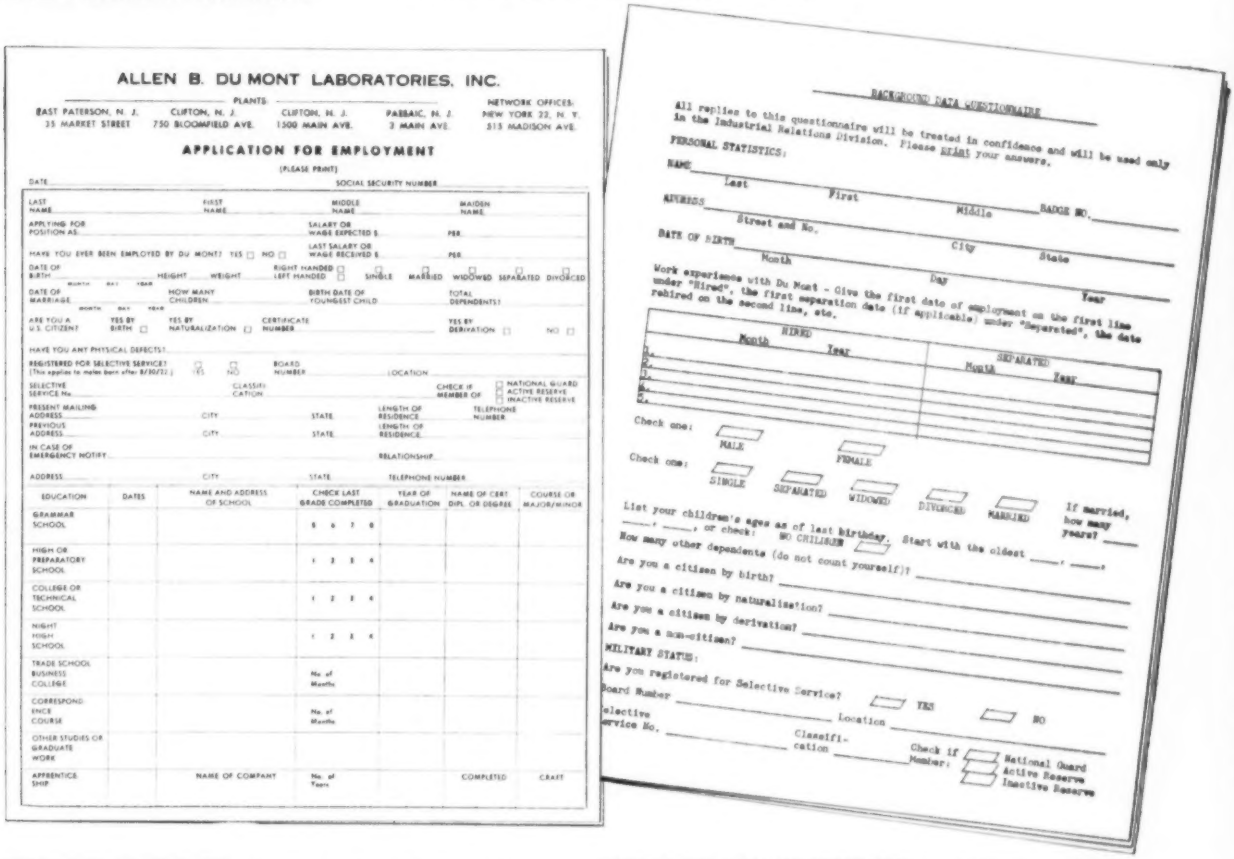
Two administrative problems were also apparent: A system was required to consolidate the variously collected information and some form of stock control was necessary for the rapidly growing "abilities inventory."

Central files were set up to bring together this information about each employee. Then a serious problem developed in the personnel department as it

Selection, training, and upgrading of personnel are industrywide problems. To accomplish them satisfactorily is difficult. Ignoring them can be disastrous. Like an engineering problem, the solution is only possible when *all* factors are available. Here is a largely successful program developed, after intensive study, by the Allen B DuMont Laboratories, Inc, with the help of Rensselaer Polytechnic Institute.

DEVELOPMENT

BY WM M STOCKER, JR, ASSOCIATE EDITOR



ALLEN B. DU MONT LABORATORIES, INC.

PLANTS

EAST PATERSON, N. J. — 35 MARKET STREET
CLIFTON, N. J. — 750 BLOOMFIELD AVE.
CLIFTON, N. J. — 1500 MAIN AVE.
PASSAIC, N. J. — 3 MAIN AVE.

NETWORK OFFICES: NEW YORK 22, N. Y. — 515 MADISON AVE.

APPLICATION FOR EMPLOYMENT

(PLEASE PRINT)

DATE ____ SOCIAL SECURITY NUMBER ____

LAST NAME ____ FIRST NAME ____ MIDDLE NAME ____ MAIDEN NAME ____

APPLYING FOR POSITION AS ____ SALARY OR WAGE EXPECTED $ ____ PER ____

HAVE YOU EVER BEEN EMPLOYED BY DU MONT? YES ☐ NO ☐ LAST SALARY OR WAGE RECEIVED $ ____ PER ____

DATE OF BIRTH ____ HEIGHT ____ WEIGHT ____ RIGHT HANDED ☐ LEFT HANDED ☐ SINGLE ☐ MARRIED ☐ WIDOWED ☐ SEPARATED ☐ DIVORCED ☐

DATE OF MARRIAGE ____ HOW MANY CHILDREN ____ BIRTH DATE OF YOUNGEST CHILD ____ TOTAL DEPENDENTS ____

ARE YOU A U.S. CITIZEN ____ YES BY BIRTH ☐ YES BY NATURALIZATION ☐ CERTIFICATE NUMBER ____ YES BY DERIVATION ☐ NO ☐

HAVE YOU ANY PHYSICAL DEFECTS? ____

REGISTERED FOR SELECTIVE SERVICE? (This applies to males born after 8/30/32.) YES ☐ NO ☐ BOARD NUMBER ____ LOCATION ____

SELECTIVE SERVICE No. ____ CLASSIFICATION ____ CHECK IF MEMBER OF ☐ NATIONAL GUARD ☐ ACTIVE RESERVE ☐ INACTIVE RESERVE

PRESENT MAILING ADDRESS ____ CITY ____ STATE ____ LENGTH OF RESIDENCE ____ TELEPHONE NUMBER ____

PREVIOUS ADDRESS ____ CITY ____ STATE ____ LENGTH OF RESIDENCE ____

IN CASE OF EMERGENCY NOTIFY ____ RELATIONSHIP ____

ADDRESS ____ CITY ____ STATE ____ TELEPHONE NUMBER ____

EDUCATION	DATES	NAME AND ADDRESS OF SCHOOL	CHECK LAST GRADE COMPLETED	YEAR OF GRADUATION	NAME OF CERT. DIPL. OR DEGREE	COURSE OR MAJOR/MINOR
GRAMMAR SCHOOL			5 6 7 8			
HIGH OR PREPARATORY SCHOOL			1 2 3 4			
COLLEGE OR TECHNICAL SCHOOL			1 2 3 4			
NIGHT HIGH SCHOOL			1 2 3 4			
TRADE SCHOOL BUSINESS COLLEGE			No. of Months			
CORRESPONDENCE COURSE			No. of Months			
OTHER STUDIES OR GRADUATE WORK						
APPRENTICESHIP		NAME OF COMPANY	No. of Years		COMPLETED	CRAFT

BACKGROUND DATA QUESTIONNAIRE

All replies to this questionnaire will be treated in confidence and will be used only in the Industrial Relations Division. Please print your answers.

PERSONAL STATISTICS:

NAME ____ Last First Middle BADGE NO. ____

ADDRESS ____ Street and No. City State

DATE OF BIRTH ____ Month Day Year

Work experience with Du Mont - Give the first date of employment on the first line under "Hired", the first separation date (if applicable) under "Separated", the date rehired on the second line, etc.

	HIRED Month	HIRED Year	SEPARATED Month	SEPARATED Year
1.				
2.				
3.				
4.				
5.				

Check one: MALE ☐ FEMALE ☐

Check one: SINGLE ☐ SEPARATED ☐ WIDOWED ☐ DIVORCED ☐ MARRIED ☐ If married, how many years? ____

List your children's ages as of last birthday. Start with the oldest ____, ____, ____, or check: NO CHILDREN ☐

How many other dependents (do not count yourself)? ____

Are you a citizen by birth? ____

Are you a citizen by naturalization? ____

Are you a citizen by derivation? ____

Are you a non-citizen? ____

MILITARY STATUS:

Are you registered for Selective Service? YES ☐ NO ☐

Board Number ____ Location ____

Selective Service No. ____ Classification ____ Check if Member: ☐ National Guard ☐ Active Reserve ☐ Inactive Reserve

EMPLOYMENT APPLICATION determines background data such as amount and type of education and training, previous work experience, military status and hobbies. It is a four-page form, of which the last page is filled in by Industrial Relations to provide review data, starting date, and other administrative information

BACKGROUND DATA QUESTIONNAIRE is similar to employment application, is used to get full particulars from present, older, employees who were hired prior to the use of the comprehensive application form. Of unique interest, are questions regarding the time required to get to and from work each day and the cost

attempted to maintain fair treatment of employees in giving each one an opportunity to be considered for promotion as vacancies occurred. There was no way to rapidly search the now extensive files to give equal and thorough consideration to all qualified and eligible employees.

An IBM Electronic Statistical Machine (No. 101) solved the problem. This keypunch card system was utilized to re-record and facilitate handling of this personnel information. Individual record cards were designed to carry the pertinent information. Identification of each card is by employee number only. In addition to this identification, one card contains age; seniority for profile development purposes; education, including amount, type, specific courses completed, and course level; previous work experience, and active hobbies. A second card reflects the same identification information of employee number, age, and seniority, plus all of the personnel test data. Traits and characteristics for which each person is tested are scored and ultimately punched on a seven-point scale. A third card is devoted to periodic indications of each employee's job performance.

Thus, an employees profile consists of an inventory of his skills, abilities, interests, personality, background, experience, hobbies, education, and work performance. Within a few minutes all of these factors can be reviewed for any individual, or a specific group of people having mutual characteristics. (Manual keypunch could be used for smaller organizations.)

In addition to improving morale by promotion from within, skills, abilities, and experience located within the company are conserved. Executives, supervisors,

PART I. SPECIFIC JOB CHARACTERISTICS

Note: Check (in appropriate ( )) the generally best fitting description of employe for each job characteristic according to best knowledge based on performance in present type of work.

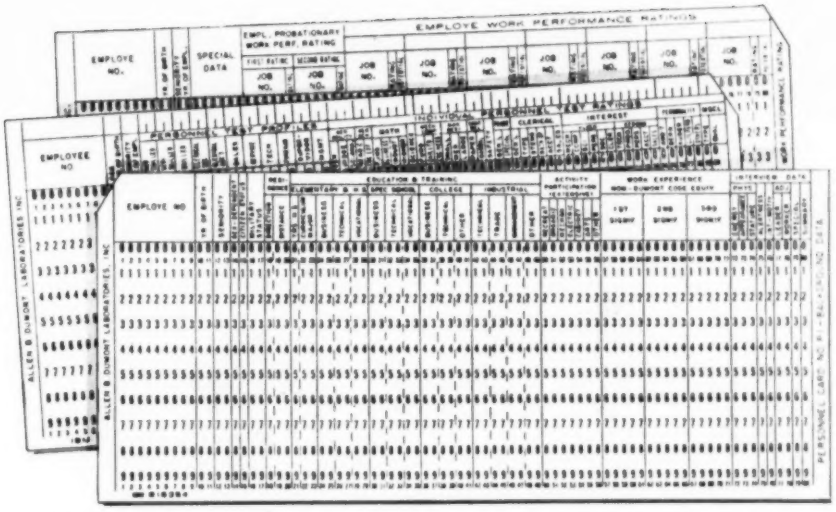
	7	6	5 4 3	2	1
JOB KNOWLEDGE AND SKILL Does he (she) know and understand his (her) job duties and equipment and their tie-up with other operations? *Indicate area of misunderstanding	Does not know or care to know even basic job requirements. Needs constant instructions.	Knows some of fundamental job duties; needs frequent refreshing on others, however	Just about enough knowledge of own job requirements. No idea of relationship of his job to other operations.	Knows own job duties quite well. Fair knowledge of relationship to other operations.	Excellent grasp of own job requirements and tie-up with other operations.
LEARNING ABILITY Does he (she) understand instructions and grasp new ideas quickly? Does he (she) learn rapidly?	Grasps new ideas and understands instructions very slowly. Very slow to learn.	Instructions must be repeated several times before fully understood. Does not understand new ideas quickly.	Ability to understand new ideas and instructions is about average.	Quick to grasp new ideas. Usually understands directions at once.	Outstanding ability to understand directions and to grasp new ideas.
QUALITY CONTROL How well does he (she) meet the standards of quality control?	Very often he (she) fails to meet quality control standards for his (her) part of the work.	Often he (she) fails to meet quality control standards for his (her) part of the work.	Usually he (she) meets quality control standards for his (her) part of the work.	Nearly always he (she) meets quality control standards for his (her) part of the work.	Seldom, if ever, does he (she) fail to meet quality control standards for his (her) part of the work.
QUANTITY OF WORK How well is he (she) able to keep to production standards?	Very often he (she) fails to meet production standards.	Often he (she) fails to meet production standards.	Usually he (she) meets production standards.	Nearly always he (she) meets production standards.	Seldom, if ever, does he (she) fail to meet production standards.
SCRAP Does he (she) produce with a minimum amount of scrap or damage material?	Very often he (she) produces a considerable amount of scrap or damages material.	Often he (she) produces a considerable amount of scrap or damages material.	Usually he (she) produces only a limited amount of scrap or damages material.	He (she) produces only a minimum amount of scrap or damages material.	Seldom does he (she) produce any scrap or damages material.
SAFETY KNOWLEDGE AND PRACTICE Does he (she) know and practice safety rules and methods?	Appears not to know or understand safety rules. Frequently endangers himself and others.	Is occasionally thoughtless of safety rules and methods. Unsatisfactory safety record.	Average safety record. Usually follows all safety rules and methods.	Good safety record. Never fails to observe rules and methods of safety.	Excellent safety record. Not only follows rules but has made safety suggestions.
JOB HOUSEKEEPING Does he (she) keep his (her) work area and equipment in a clean and orderly condition?	Very often his (her) work area and equipment are in a dirty or disorderly condition.	Often his (her) work and equipment are in a dirty or disorderly condition.	Usually his (her) work area and equipment are in a clean and orderly condition.	Nearly always his (her) work area and equipment are in a clean and orderly condition.	Seldom, if ever, are his (her) work area and equipment in other than a clean and orderly condition.
INTEREST AND ATTITUDE Does he (she) have a strong interest in his job and a good attitude toward his work?	Is uninterested in his job and has poor attitude toward his work.	Indifferent to job. Does not show much desire to do his (her) work.	Interested enough in his (her) job to do acceptable work but not overly enthusiastic.	Has a lively interest and attitude toward his (her) work.	Very enthusiastic about his (her) job and the work going on in the organization.
COOPERATIVENESS Does he (she) get along with fellow workers?	Often antagonizes others. Has very few friends. Uncooperative.	Is inclined to stay by himself. Fails to attract people or to make friends easily.	Has the usual number of friends. Fairly good disposition. Cooperative.	Good personality. Makes friends easily and creates satisfactory impression.	Excellent personality. Is liked by and gets along with everyone.
SELF CONTROL Does he (she) have self-control?	7 Easily upset by minor incidents. Moody. Irritable.	6 Rather prone to anger and moodiness.	5 4 3 Satisfactory self-control in ordinary situations.	2 Even temperament. In good spirits most of the time. Not irritated by minor mishaps.	1 Excellent composure even under difficult conditions.
INITIATIVE Is he (she) a self-starter? Does he (she) make useful suggestions?	Completely lacks "get up and go". Does not even make poor suggestions.	Does just enough to get by. Follows routine but rarely thinks for himself.	Can handle routine matters without close supervision. Occasionally makes useful suggestions.	Has many new ideas and suggestions. Takes good steps to meet new situations. Always keeps busy.	Frequently finds better ways to do things. Makes many suggestions and is eager to assume new responsibilities.
JUDGEMENT Is he (she) able to size up a problem and make a good decision?	Continually makes quick and unwise decisions. Lacks common sense.	Does not always use common sense. Frequently acts unwisely.	Uses good judgement in most circumstances.	Rarely fails to make wise decisions. Usually gets all facts and employs common sense.	Uses excellent judgement under pressure and in unusual circumstances. Collects all the facts.
DEPENDABILITY Can he (she) be counted on to see a job through?	Gives up easily. Leaves most of his (her) work unfinished.	Can not be relied upon to complete a job without close supervision. Unwilling to accept responsibility.	Keeps at a job until it is done, with only the usual amount of supervision.	Follows job to completion. Needs very little supervision.	Does a job thoroughly, without supervision. Investigates all possibilities.
APPEARANCE Does he (she) appear neat and suitably dressed? Does he (she) make a favorable impression?	Comes to work sloppily dressed and not in suitable clothes for type of work.	Not always dressed suitably for type of work. Does not maintain neat appearance throughout day.	Wears customary dress for job. Is average in neatness.	Is always suitably dressed. Stays neat all day. Makes a good impression.	Has good taste in clothes for type of job. Always makes very favorable impression.
ATTENDANCE AND PUNCTUALITY Is his (her) attendance and punctuality satisfactory? Are reasons good? Does he notify?	Repeatedly absent or late without satisfactory reason. Usually fails to notify.	Although notifies, frequently absent or late for minor reasons.	Satisfactory absence and attendance record. Notifies.	Only occasionally absent or late and only for good reasons. Always notifies.	Excellent attendance record. Always on time. Makes every possible effort to be present and on time.
PHYSICAL ENERGY Does he (she) have pep and energy?	Seems to be "done in" all the time. No pep	Is somewhat below normal in energy.	Has average amount of physical energy.	Impresses one as being lively and energetic	Never listless or lacking in alertness. Radiates good health and energy.
OTHER JOB CHARACTERISTIC	7	6	5 4 3	2	1

PART II. SUMMARY OVER-ALL RATING

Note: Give this employe an over-all or summary rating for HIS PRESENT TYPE OF WORK by checking the rating below which BEST DESCRIBES this employe.

I.B.M. Job Code: Card P4 Cols. 25,31, etc. (____)

7	6	5	4	3	2	1
An employe who has not demonstrated the qualifications for satisfactory performance that one should reasonably expect for this type of work.	An employe whose work performance is below standard in several areas of this type of work.	An acceptable employe in this type of work but whose work performance is limited in some respects.	A satisfactory employe for this type of work	A satisfactory employe for this type of work but whose work performance is better than average in several respects.	A very fine employe for this type of work who is of great value to the organization.	A highly outstanding employe for this type of work.



KEYPUNCH CARDS, used in conjunction with IBM Electronic Statistical Machine No. 101, speed location of personnel in any category or ability grouping. Three cards, one based on the original application or background questionnaire, the second assembled by coding the personnel test profiles and test ratings, and the third containing coded work-performance ratings, provide a very complete inventory. Cards are only used to locate appropriate people, then original forms are studied

foremen, and technicians are developed with the help of this plan. Each employee is encouraged to help himself by making available to him indications of areas of possible improvement. But this is only done at the employee's personal request, at which time he discusses with the personnel counselor the development of his profile.

how the system works

To fill a vacancy, an individual, many-part requisition is prepared by the supervisor of the position vacancy. The personnel requisition is approved by his division head for budgetary reasons and then audited by the wage and hour administrator to verify the appropriateness of job code, title, and rate. Then the request is routed to the Profile Development Section which searches the files of present employees to find those people suitable for the opening. Further screening of the employees for whom this vacancy would be a promotion is done on the basis of specific requirements. Only after this search shows no qualified present employee is the vacancy filled from applicants on the outside.

For new employees, a comprehensive application blank is filled out by the applicant, then the completed form, for the accepted applicant is routed to the Profile Development Section before being sent to Central Files. At PDS the background data card is initiated. (A special questionnaire was designed to obtain this information from the present, older employees, thus have the record complete.) During initial screening, applicants are given personnel tests to aid in determining acceptability. These tests are administered either before or after the interviewers final interview, but always before final acceptance. Again, test results are recorded by PDS, this time on the test profile card.

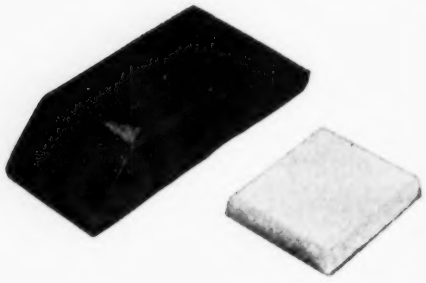
General ability is measured by various intelligence tests with emphasis on non-language abilities for routine production workers and special emphasis on verbal factors for certain clerical positions. Applicants for technical and supervisory positions are screened by tests stressing both the language and non-language aspects of general ability. Mechanical or clerical aptitudes, dexterity, reading, typing, or stenographic skills are measured when appropriate. Interest and personality patterns are obtained for applicants in higher-level job categories.

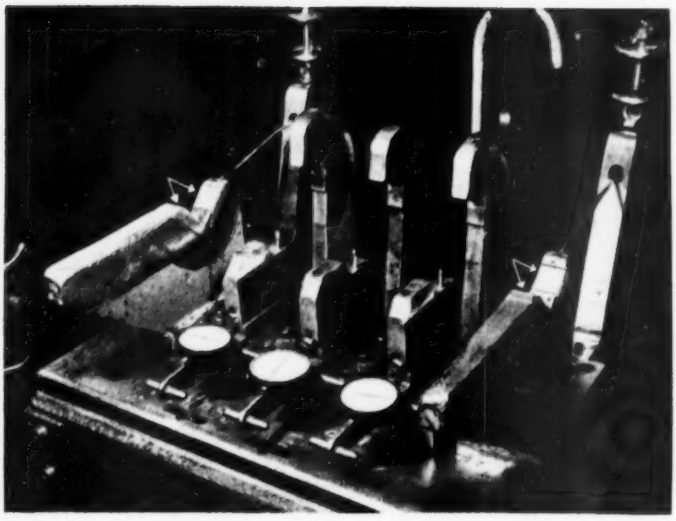
Work-appraisal reports (job performance within the company) are given considerable weight in the profile; are based on the merit rating form prepared by the supervisor for each employee at the end of the first six months and once each year thereafter. These reports are summarized and punched on the work appraisal card.

Thus, employees are encouraged to make DuMont their life's work; are guided in developing a career with the company. The program locates well-qualified employees for promotional vacancies and gives all employees fair opportunity to qualify for advancement. To the company's benefit, personnel are more efficient in fulfilling their responsibilities, there is less turnover, and the problem of locating suitable help is reduced.

Each employee is given a pamphlet which explains the plan in a series of 12 questions and answers. Along with the points just discussed, it explains that profile testing is *not* the same as pre-employment testing. While the latter only determines whether the applicant has a reasonable chance for success on the job, the profile test uses complete batteries. However, pre-employment tests become part of the profile. It also tells how profiles *develop* through additional training, improved test scores, and work-performance ratings. The IBM machine *does not select* the person to be promoted. It only "searches" and selects the candidates. Selection is made after a thorough study of each candidate's records and interviews.

◀ **WORK-APPRAISAL REPORT** is a four-page comprehensive questionnaire filled in by immediate superior at each level to determine merit rating. Five forms, individually colored for identification, cover foremen, salaried supervisory personnel, technical personnel, salaried non-supervisory personnel, and hourly wage workers. Each form contains specific questions for the classification being rated. (Form shown in detail is for hourly wage worker.) Unusual aspect: After completion, person being rated reviews report with his supervisor and his remarks are placed on the form and signed by him





CRANKSHAFT-STRAIGHTENING FIXTURE (right) was fitted with four nylon pads (above, right) which wore only 5/64 in. over two months—enough time to wear out three sets of standard pads (above, left) on another machine close by. Nylon surface was then 3/16 in. deep, enough for another three months of wear. Square piece of nylon was inserted in bronze pad that bolted into fixture

HOW ABOUT NYLON FOR WEAR PARTS?

Answer: Yes, where you need a material with abrasion resistance, low friction, no lubricating needs, and soft action on polished metal surfaces. No, if you must have high rigidity, heat resistance above 300 F, and zero moisture absorption. Here are pictures and details on how some metalworking plants use nylon where its special properties really count . . .

BY R B ZIMMERLI, Product Development Mgr, THE POLYMER CORP OF PENNSYLVANIA

In the wide-open field of applying plastic materials to machine design and construction for specific purposes, nylon is proving valuable in many instances where only metals would have been considered in years past.

Several shops, for example, have installed nylon cams on automatic screw machines where the machines work only on nonferrous metals and plastics. The nylon resists abrasion, provides smooth cam surfaces and quiet operation, and has long life. In other lathe applications, the material is made into spindle liners that protect polished shafts, even if they are steel, and eliminate much of the usual noise; it is cut to make collets, which grip the work well and do not damage it; and it is made into collet stops which are long-lasting and tough.

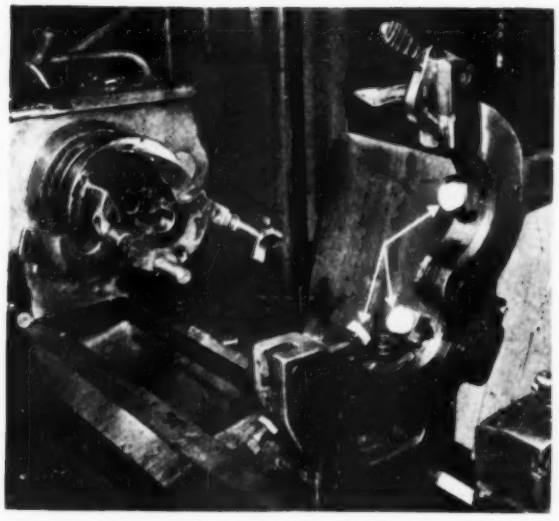
Dies have been made of nylon for drawing soft aluminum parts. Here the advantage is also in protecting the metal; steel dies had to be lubricated, and the oil contaminated the aluminum. But nylon dies do not require lubrication, so the stock stays clean.

An interesting application has developed in the rubber industry, where nylon rolls are made to carry sheet rubber and similar materials while being processed and trimmed on the edges. Nylon is tough enough to withstand the sharp cutting edge of the circular knife, but is also soft and flexible enough to have little dulling effect on the knife itself. The result is increased life for both roller and knife.

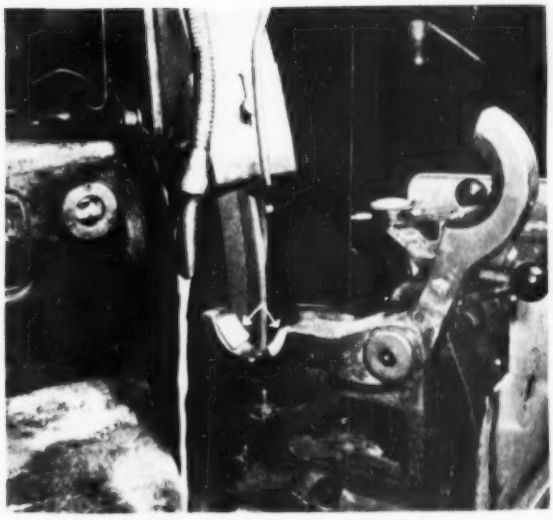
Rollers and guides for milling fixtures work well when made of nylon. The material's abrasion resistance preserves the parts of the fixture that receive the most wear, which extends the total fixture life. This idea is particularly adaptable for cutoff work and other simple setups.

Lathe and grinder steadyrests are another application for nylon. The bearing surface, flat or circular, can be pads of nylon inserted in milled-out slots in the regular steadyrest jaws. On the basis of direct comparison, nylon has outlasted conventional materials in steadyrest jaws 10 times.

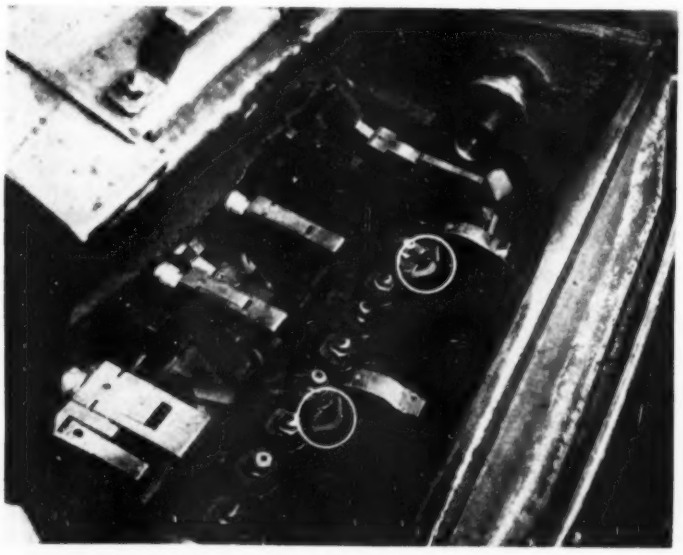
A number of wire-producing companies prefer nylon sheaves and pulleys because of their wear resistance and smoothness. They



STEADYREST JAWS that center crankshaft for rough and finish boring on lathe are nylon. Plastic had been in use 11 months when photo was taken—enough time to wear out 11 sets of regular pads. Nylon also required less adjustment by operator and gave more uniform support



GRINDER STEADYREST holds crankshaft for flange finishing; is good for another year of work after six months of service. Nylon here replaces pads that wore out in two or three weeks; only shows 1/16 in. of wear. Abrasive grit and sludge seems to have little if any effect on pads



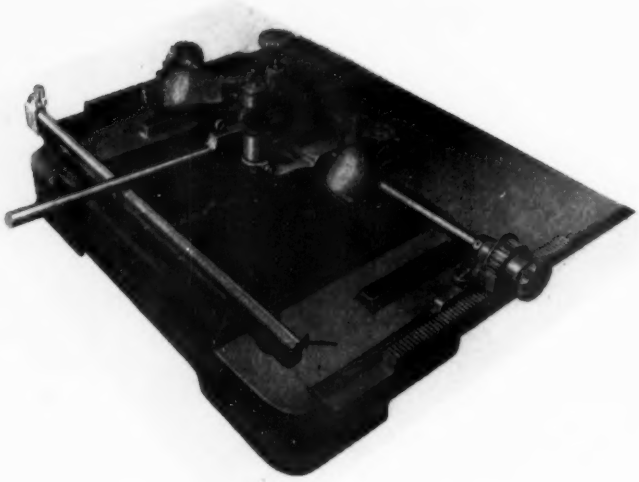
POLISHING MACHINE where crankshafts are finished is application where nylon shoes replaced ball bearings. Original bearings clogged from abrasive dirt; wore out in a month. Nylon required two adjustments in four months; is expected to last a year

compare favorably with older metal pulleys, which eventually roughen and damage the wire that is pulled over them.

HOW NYLON ACTS

Nylon resists chip penetration well, and therefore works on tooling where metals are being cut. It also has a flow-over characteristic that gradually imbeds bits of chips and grit that are worked into the surface, which presents a new, smooth surface to the work. Thus, bearing surfaces in which polish metal rides do not scratch or marr the metal.

One of the strongest nylon formulations is FM-10001, the most widely applied material marketed as stock shapes and fabricated parts by Polymer of Pennsylvania. When bone dry, it has a modulus of elasticity of 400,000 psi; when 2 to 3% moisture is present, this drops to 250,000 psi; and at 8% moisture content the modulus is 100,000 psi. It melts sharply at 505F, and suffers from oxidation embrittlement when held at 220F over a long period of time; however, special heat-resisting formulations are



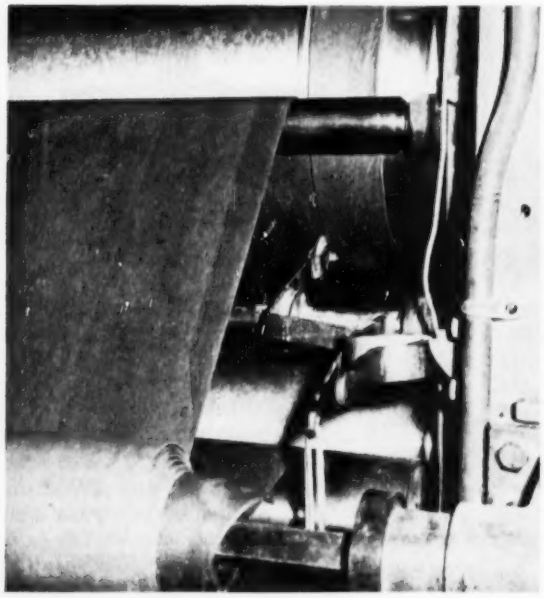
ENGRAVING ROUTER is fitted with nylon guide bar, which can be rotated after wear, and provides smooth sliding action. Abrasion resistance and low friction increase life of guide bar assembly

available. Chemical resistance is high, and it weighs less than half of aluminum.

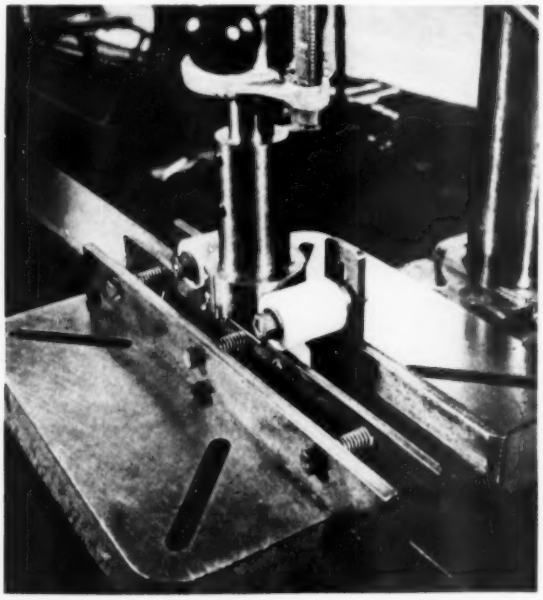
Nylon machines smooth and flat to an accuracy of 0.001 in., although its characteristic expansion under conditions of heat or moisture make it more generally cut to wider tolerances. Simple tooling and simple setups are sufficient for cutting stock to shape. In applications where large sections are required, the material works best as pads inserted in structural metal shapes.

It is available in stock shapes, including rod up to a 4-in. dia, strip as thick as 1/8 in., bushings up to a 10-in. OD, disks to a 12-in. dia, slabs, and special shapes made up as required on special order.

As the accompanying photos indicate, applications of nylon are widespread. The material has been used, in addition to the examples above, in cutter mandrels, gears, ways, wear surfaces for pallets, and others. Because of its high mechanical strength, it is particularly adaptable for very thin sections.



RUBBER SHEETING IS SLIT on calendar roll by nylon knife, which saves steel roll from scoring, even though knife must be sharpened more often. Result is minimized damage to roll, less downtime



MILLING FIXTURE ON DRILLPRESS incorporates nylon rollers and guides to maintain constant pressure on stock being forced through. Material prevents scoring or marring

QUALITY of a protective atmosphere is conveniently checked with a quartz-tube furnace

HOW TO CURE Protective-Atmosphere Troubles

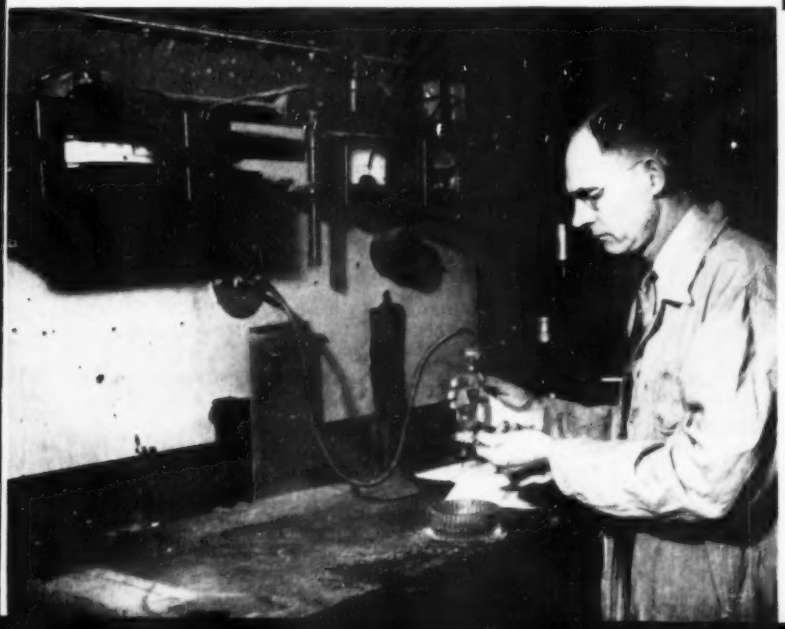
Metalworking now has thousands of furnaces that turn out bright and shiny ferrous and non-ferrous articles, or at least pieces clean and free from scale.

This was not always so. Only a few years ago, heat-treaters and metallurgists did not understand the chemical reactions that take place within a furnace. But when they learned the facts of protective atmospheres, heat-treating took a long step forward in usefulness.

The protective-atmosphere furnaces installed in your shop, or soon to be put into service, need care and maintenance like any other piece of equipment. From time to time, you are going to find things going wrong. Then it is up to you to recognize the fault and to apply the proper remedy.

To make this easier for you, we are preprinting a chapter from the authors' forthcoming book "Protective Atmospheres," through the kindness of John Wiley & Sons, Inc, the publishers.

DEWPOINT of gas sample from furnace chamber is read with a dewpoint potentiometer



SAMPLE OF GAS in furnace chamber being taken with sampling bottle for laboratory analysis in a burette

BY A G HOTCHKISS, Section Engineer,
and H M WEBBER, Application Engineer,
INDUSTRIAL HEATING DEPT, GENERAL ELECTRIC CO

American Machinist SPECIAL REPORT NO. 337
TO THE METALWORKING INDUSTRIES

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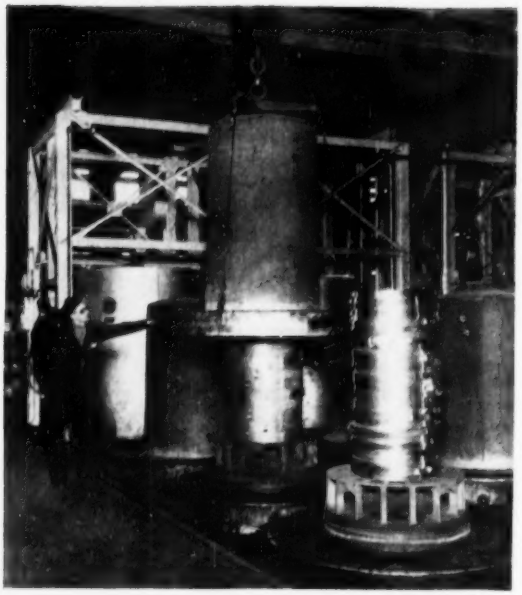
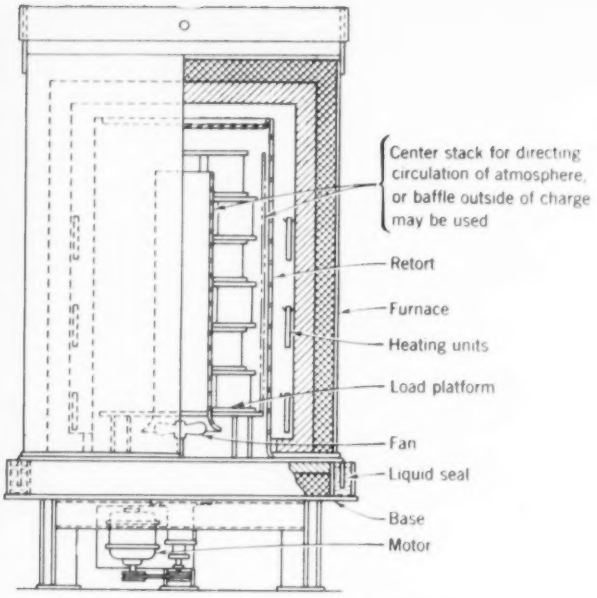




CONTAMINATION of the atmosphere in a furnace, as by air infiltration, occurs from failure to maintain positive pressure in the retort of a bell-type furnace, regardless of whether it is sand-sealed or liquid sealed. Both of these are liquid sealed. Always remove the furnace slowly from the retort to avoid shrinking the gas content faster than the inlet can supply make-up atmosphere

ATMOSPHERE IMPURITIES CAUSE VARIOUS TROUBLES

WHEN starting a new heat-treating installation, or in operating and maintaining existing equipment, you may sometimes obtain undesirable or unexpected results. If difficulties develop, a quick solution is usually possible, if the reason for atmosphere troubles can be readily ascertained.

In diagnosing furnaces troubles, it is desirable to separate applications into two classes of change in the work surface: oxidation and reduction, and metallurgical changes.

Oxidation, which results in scaling or discoloration of ferrous metals, is caused by atmosphere constituents: oxygen, water vapor, and carbon dioxide. Nonferrous metals also are discolored by oxygen and sulfur. *Reduction*, which results in restoring an oxide to its basic element, is usually caused by hydrogen and carbon monoxide in protective atmospheres.

A metallurgical change, which results in decarburization, is caused by oxygen, water vapor, and carbon dioxide; carburization is caused by carbon monoxide and hydrocarbons, such as methane.

IMPURITIES IN ATMOSPHERES

Discoloration and decarburization are the most common ailments in protective-atmsophere applications. Atmosphere impurities and their possible sources are:

A. Oxygen may come from:

1. Air leakage into furnace chamber.
2. Air carried into furnace with work.
3. Free oxygen in generated atmosphere gas.
4. Oxygen in atmosphere from cooling water.

B. Water vapor may come from:

1. Oxide on work entering furnace (in contact with a reducing gas).
2. Surfaces of parts entering furnace.
3. Atmosphere gas introduced into furnace.
4. Re-formation of atmosphere gas under heat (water-gas reaction).
5. Leakage from water-jacketed members (cooling chamber, door fronts, etc).

C. Carbon dioxide may come from:

1. Atmosphere gas as generated.
2. Air leakage if atmosphere gas contains CO.
3. Re-formation of atmosphere gas under heat.

D. Sulfur may come from:

1. Fuel gas used in atmosphere gas producer.
2. Air burned with fuel gas.
3. Lubricants on work surface.
4. Brickwork and insulation.

E. Carbon monoxide may come from:

1. Atmosphere gas as generated.
2. Vapors from oil on the work.

F. Methane may come from:

1. Atmosphere gas as generated.
2. Lubricants on the work.
3. Deliberate addition to atmosphere gas after generation.

Inspection of the work may reveal the impurity causing the trouble. At other times, it is necessary to run special tests to determine the cause.

tests for oxidation or other discoloration

NONFERROUS METALS

Copper is unaffected by water vapor or carbon dioxide. Two constituents that do cause trouble are oxygen, which makes copper oxide, and sulfur, which produces copper sulfide. Degree of surface discoloration resulting from these two impurities can often be differentiated by visual appearance. If oxidation is substantial, it will be loose scale or a reddish surface film. If oxidation is light, its color may be a light pink and sometimes iridescent.

TEST FOR DISTINGUISHING SULFIDE FROM OXIDE

1. Immerse the discolored sample in dilute sulfuric acid. If the discoloration is removed rapidly and a clean copper-colored surface remains, the discoloration is an oxide; otherwise it is almost certain to be sulfide. Sulfide is not affected by sulfuric acid, but is dissolved by dilute sodium or potassium cyanide.

Effects of Oxygen. An annealing atmosphere generally contains 0.5 to 1.0% hydrogen. Thus, any small infiltration of oxygen is neutralized at elevated temperatures. Further, any copper oxide present when the temperature is about 350 F or above is reduced. Between 350 F and 150 F, the copper may become oxidized upon cooling. The oxidation rate below 150 F is negligible, and therefore copper is generally cooled to this point before removal from the furnace. Any oxygen infiltration in the 350 F to 150 F range will produce an oxide that cannot be reduced by the gas.

Effects of Sulfur. In general, sulfur produces a reaction in the form of hydrogen sulfide (H_2S). This is very active to copper, nickel, and silver, or alloys rich in these metals. If atmosphere gas contains no hydrogen, then sulfur, as present in drawing or rolling lubricant, can cause no discoloration. But a small amount of hydrogen will combine with the sulfur to form active hydrogen sulfide.

TESTS FOR PRESENCE OF SULFUR

2. To detect hydrogen sulfide (H_2S), wet white filter paper with a saturated solution of lead acetate and hold in a small stream of the protective-atmosphere gas. Hydrogen sulfide will change the color of the paper from white to light brown or black. For the gas to be considered sulfur-free, the test paper should show no color after about one minute of contact with the gas stream.

3. Nonmetallic materials—brick, mortar, insulation, lubricants, etc—suspected of containing sulfur, can be tested by heating them in hydrogen and checking the discharge gas for hydrogen sulfide by test 2.

4. Metallic materials discolored or attacked on the surface can be checked for presence of sulfur by the following method: Into a beaker pour a small amount of 10% hydrochloric acid solution, and add a small amount of granular zinc. Drop the test sample into the beaker and cover with lead acetate test paper. Reaction of the zinc with the acid will give off nascent hydrogen. This combines with any sulfur present on the sample to form hydrogen sulfide; which in turn will discolor the test paper.

Effects of Zinc. Alloys rich in copper react, in general, like copper. However, if zinc content is high, as in yellow brass, discoloration may result from zinc distillation. This is usually shown up as a deposit ranging from a light gray to white, along with roughening of the surface. The zinc film on parts can become oxidized by small amounts of oxygen, water vapor, carbon dioxide, and carbon monoxide in furnace atmosphere.

FERROUS METALS

Clean, bright ferrous metals entering a protective-atmosphere furnace sometimes emerge discolored. To learn the cause, some detective work is necessary.

The amount of sulfur present in normal protective atmospheres does not affect the surfaces of ferrous metals.

Oxidation of ferrous metals is of two kinds: that produced in the blueing range below 900 F and that produced at higher temperatures.

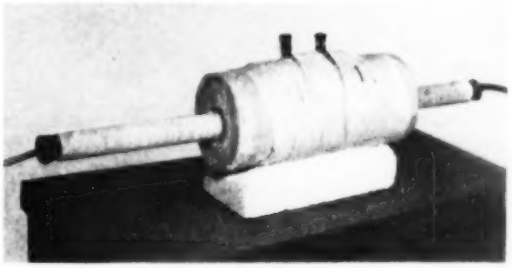
In the low-temperature range, either oxygen or water vapor can produce oxidation and discoloration, with either source resulting in about the same final appearance. Such discoloration, in the form of blueing, generally takes place during the cooling cycle.

Oxidation at high temperatures ordinarily results in etching or scaling. Oxygen tends to produce a light gray to black, dull-appearing scale which loosens upon cooling. Excessive moisture produces a more tightly adhering oxide with a darker, sometimes glossy, appearance.

The position in the furnace at which oxidation occurs can be determined by examining the product. For example, if a steel part which had a shiny reflective surface emerges from a continuous furnace with a bright but etched or roughened surface, oxidation from some source has occurred near the front of the furnace during the heating-up period, followed by reduction of the oxide and proper protection from further oxidation during the cooling cycle.

TESTS FOR CAUSES OF OXIDATION

5. One method is to heat treat a bright copper test piece along with the steel. Copper is oxidized by oxygen but not by water vapor,



SULFUR in brickwork, insulation, etc, can be determined by placing samples in a quartz-tube furnace, flowing hydrogen through the furnace and checking the discharge gas for hydrogen sulfide

revealing which impurity is present. Do not be misled by a possible sulfur discoloration on the copper, as previously mentioned.

6. Test either the atmosphere gas, as generated, or a sample from the furnace chamber by means of a small tube-type test furnace brought to red heat. After the quartz tube is purged, wire or strips of bright steel or copper, or both, are pushed into the furnace and the stopper is replaced. The samples should be longer than the furnace so that both ends remain cold while the center is brought to furnace temperature.

After the samples have reached furnace temperature, power is shut off and sufficient flow of atmosphere maintained to prevent entrance of air. After the furnace has cooled to at least 200 F, the samples can be removed for inspection. Their color will indicate whether the atmosphere can maintain a bright surface or produce discoloration. The type of discoloration obtained should indicate whether the trouble is caused by oxygen or moisture. Oxygen will discolor both steel and copper. Moisture will discolor steel but not copper.

In the absence of a test furnace and quartz tube, a similar test can be conducted in a piece of well cleaned iron or alloy tubing with samples at a spot near the center of the length, applying a torch and bringing the tube up to a red heat for two or three minutes; then cool with the temperature gas still flowing.

Sometimes discoloration is a result of heavy oil or foreign material baked on during furnace treatment. If such discoloration cannot be rubbed off, leaving a bright surface, pickle in dilute hydrochloric or sulfuric acid. An oxide will be removed and leave a bright surface, whereas a carbon discoloration will not pickle off readily.

Discoloration during Hardening. Parts that are being scale-free hardened in protective atmospheres by quenching through a chute sealed in oil (to avoid contact with air) are generally free from oxidation. Sometimes, however, they are found to be discolored. This discoloration may be a carbon film or it may be a film of baked-on foreign material.

table I . . **SURFACE COLORS OBTAINED BY QUENCHING CARBON STEELS IN MINERAL OIL CONTAINING WATER OR AIR AS IMPURITIES**

Thickness of Sample (In.)	Volume of Water in Quenching Oil, %				
	0.005	0.05	0.20	0.5*	Air in Oil
0.010	Bright	Bright	Bright	Straw	Bright
0.040	Straw	Deep Straw	Blue	Deep Blue	Bright
0.125					Straw
0.250	to	to	to	to	
0.50					to
0.75	Blue	Deep Blue	Blue Black	Dull Black	Deep Straw

* At this concentration the oil changed from its natural color to a brick-red color.

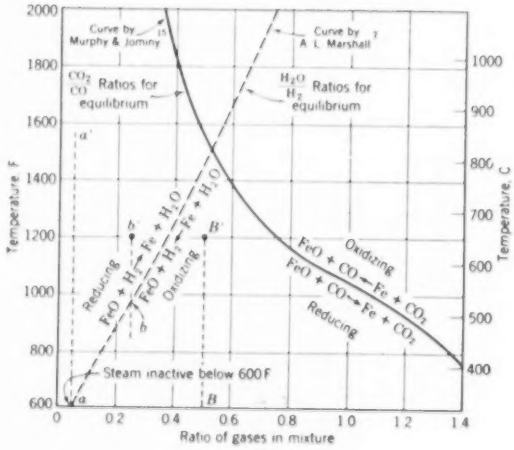
A discoloration that is a true oxide film is usually caused by either water or air in the quenching oil.

Discoloration caused by water or air, or both, increases with the cross-section of the piece and with the temperature at which the work is quenched (Table I). This discoloration from the quench may be uniform; it may appear as splotches; or it may be on only one side of the piece. Water, the cause of most discolorations, may come from condensate from the atmosphere, or from water leaks in the oil-cooling system or water-cooled quench chute. Air sometimes enters through packing glands of oil-circulating pumps and appears as foam on the surface of the oil. Water can be removed by boiling the oil and circulating it to let the steam escape.

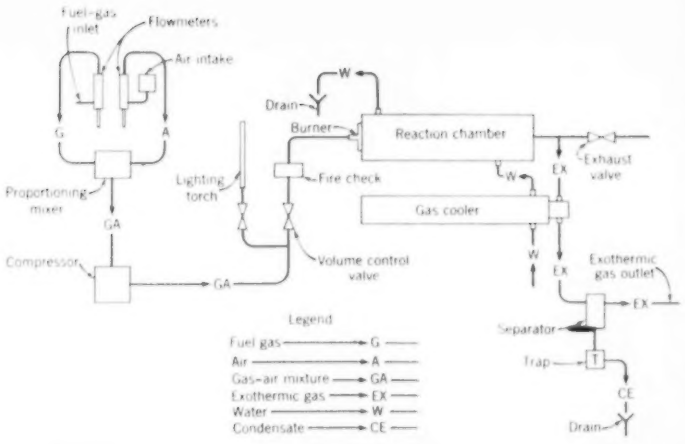
Carbon-steel parts properly processed will have clean bright surfaces after hardening, even if heavy. Alloy steels containing 1% or more of chromium may become selectively oxidized, turning dark after treatment in normal protective atmospheres.

Effects of Time and Temperature. Degree of oxidation is a function of time and temperature. If metal is heated and cooled rapidly, little oxidation occurs, even in air. An atmosphere which causes blueing of steel in a long-cycle bell-type annealing furnace, owing to excessive water vapor, might keep steel bright in a continuous furnace, where the cooling requires minutes instead of hours.

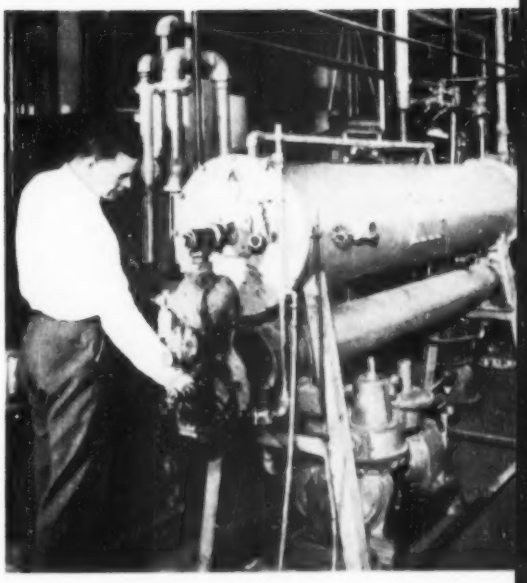
Oxidation due to water vapor and carbon dioxide is dependent on the gas equilibrium with respect to the gas, the material, and the temperature. For iron, the amount of water permissible is dependent on the amount of hydrogen present, and the carbon dioxide allowable is determined by the value of the carbon monoxide. This equilibrium condition is illustrated. A certain atmosphere may prevent oxidation at a high temperature, but the parts may oxidize while being cooled in this atmosphere at a lower temperature.



OXIDATION from water vapor and carbon dioxide is dependent on the gas equilibrium



EXOTHERMIC GAS producers (this one is rated at 2000 cu ft per hr) are widely used for providing inexpensive protective atmospheres. The hydrocarbon fuel gas is partially or completely combusted to provide a protective atmosphere with the desired chemical analysis



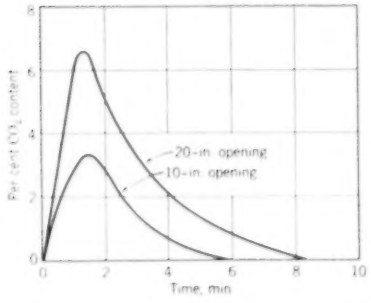
TESTS FOR LEAKS IN FURNACES

Most furnace-atmosphere troubles are caused by leakage (infiltration) of air, by moisture resulting from the chemical combination of infiltration air and the atmosphere gas, or by water leakage.

tests for air leaks

BELL FURNACE

7. Assuming a liquid-sealed retort, fill the retort with gas or air, then shut off both inlet and outlet valves. A reduction in pressure reading on a gage will indicate a leak, assuming that temperature of the retort remains constant.



CO_2 CONTENT within a box furnace increases for a time after the door is opened, because air infiltrates the gas-flame curtain and reacts with the CO in the protective atmosphere

8. If incoming atmosphere is metered, shut the outlet valve, and hold the retort under pressure. Any leakage should be indicated on the meter.

9. If a retort is thoroughly purged of air and filled with a flammable gas, leaks may be found by searching at welded seams, stuffing boxes, and other points of leakage, with a flame torch which will ignite the leaking gas. Flames are almost colorless; hence test in a darkened room.

10. Build up a gas or air pressure of 3- or 4-in. water column within the retort and apply soapy water to all seams, welds, and points where leaks could be expected. The leaks will cause bubbles to appear.

11. Air may be drawn into a tight retort and base by improper operating procedure. When a hot furnace is removed from a loaded base and the retort is suddenly exposed to room air, it cools rapidly, shrinking the gas volume in the retort. If shrinkage takes place faster than additional gas can enter from the inlet pipe, a negative pressure is produced, sucking in air through the exhaust vent or possibly through the seal chamber. The furnace chamber should be removed slowly to avoid negative pressures. Connect a U-tube pressure indicator to the inside of the retort chamber, or watch the level change in the liquid seal.

BOX-TYPE OR HORIZONTAL CONTINUOUS-TYPE FURNACES

12. With the furnace at normal operating temperature and filled with flammable gas, close all doors and openings, to establish a slight positive pressure within the chamber. Test with a flame torch, going over all welds, packing boxes, and other possible points of leakage.

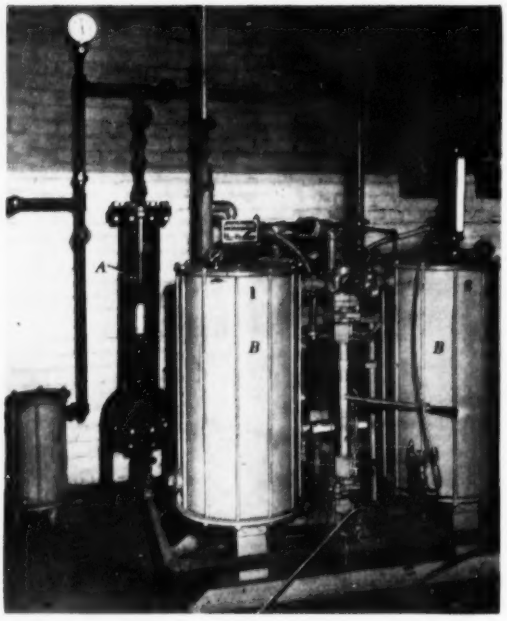
13. Leakage above the level of the bottom of the door opening will generally not be a source of air infiltration. Atmosphere leaks (outward) are of minor importance unless large.

14. Leaks below the bottom of the door opening should be considered air leaks. Leakage at this point is important. As soon as the door is opened and the pressure reduced in the furnace chamber, air will enter any such opening and can cause discoloration of the work.

15. Air leakage during normal operation can be detected by analyzing a gas sample taken from the chamber shortly after a door has been opened. Compare this analy-

sis to that of the inlet gas. Air leakage into the furnace will show a definite decrease in CO and H_2, and a corresponding increase in CO_2 and H_2O.

16. Air may enter furnaces when doors are opened to charge or discharge work. This may be caused by drafts which blow air into the furnace-door opening, by improper distribution of the flow of atmosphere gas to both ends of the furnace, or by improperly operating flame curtains at the doors. Such difficulties usually can be determined by visual inspection. The required rate of flow of atmosphere gas is sometimes related to the volume of the furnace.



HYDROGEN ATMOSPHERES may contain enough oxygen to give troublesome results. The oxygen is removed by passing the atmosphere gas through a palladium-catalyst purifier *A*, which reacts it with hydrogen to form water vapor, and a dual-chamber, regenerative-type dryer *B* to remove the water vapor

excess moisture in furnaces

METHODS FOR REDUCING CONDENSATION

17. Excess moisture in the protective atmosphere may appear as condensate in the liner of a water-jacketed cooling chamber. This collection of water will be heated by hot work entering the cooling chamber, and may cause steam to form and oxidize the work. To reduce the possibility of condensate forming at the entrance end of the cooling chamber, raise the temperature of the water-cooled jacket to about 150 or 170 F by decreasing the water flow through the chamber.

Condensation can be caused by constant flow of cooling water and intermittent transfer or temporary cessation of travel of hot trays into the cooling chamber. Automatic temperature control of the cooling water will prevent excess cooling action and thus avoid such difficulty by maintaining an even temperature in cooling-water jackets.

Condensation may be caused by air leakage which will combine with the hydrogen in the protective atmosphere to form water vapor in the furnace. Another possibility is that the entering atmosphere gas is not being properly cooled at the producer, or picks up moisture somewhere from warm water, such as in a water spray tower, or iron oxide tower that is too close to a furnace or other source of heat, and carries excess moisture with it into the furnace. Elimination of air leaks and correction of the cooling difficulty should dspose of these sources of moisture.

18. Excess moisture in the furnace and/or its protective atmosphere may be caused by direct water leakage from water cooling chambers or cooling jackets around doors, to the inside of the furnace. Such leakage usually can be found only by visual inspection. This possibility must be considered if it has been found that moisture is not coming from the sources indicated in test 17.

19. In bell furnaces with water-sealed retorts, atmosphere gas in contact with warm water on the inside lip of the seal will absorb water, to cause discoloration of the work. Provide seals with overflow pipes large enough to prevent appreciable rise in water temperature.

CONTROLLING AND TESTING FOR DECARBURIZATION

CARBON POTENTIAL VS. DEWPOINT

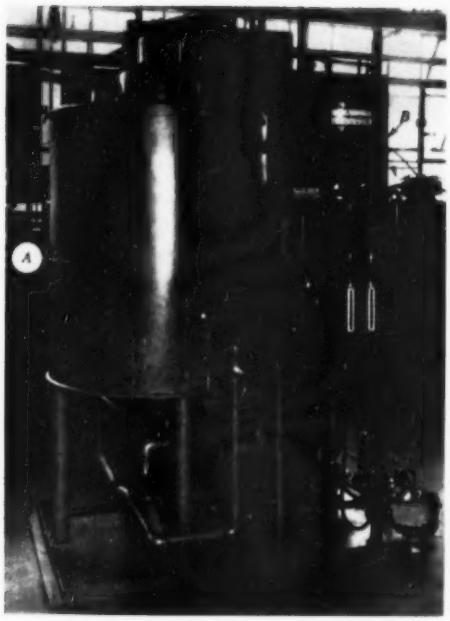
If no change in carbon content of the work is desired, establish a carbon potential in the protective atmosphere equivalent to that of the steel being treated. Carbon potential can be estimated accurately by measuring the dewpoint. A high dewpoint means a low carbon potential, and a low dewpoint indicates a high carbon potential.

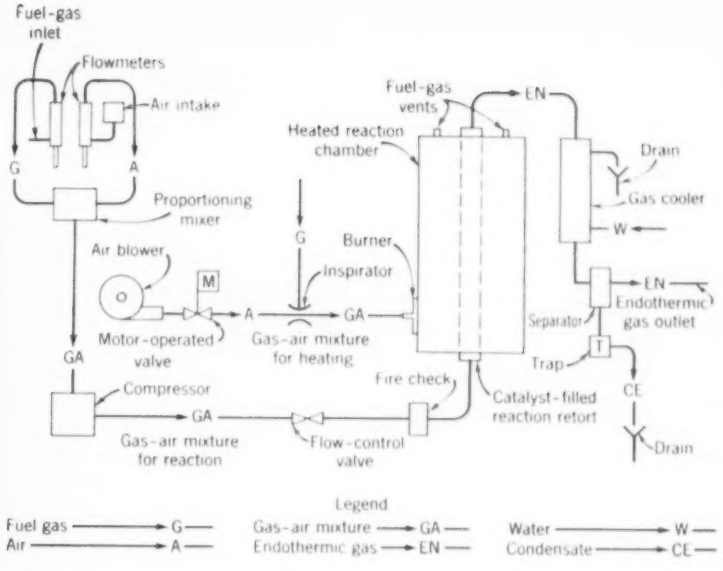
Most atmospheres contain hydrogen. Inward leakage of oxygen causes formation of water vapor and an increase in dewpoint. If the work has a coating of rust or oxide, the hydrogen will react with the oxide to form water vapor.

DRYING OUT A FURNACE

One of the first problems in establishing a carbon potential in a furnace is to be able to maintain the desired dewpoint in the empty furnace.

If the furnace is new or has been repaired and contains new brickwork, a drying-out period will be required. Usually this is accomplished by heating the furnace to the maximum temperature for which it is designed and maintaining that temperature constant for





AN ENDOTHERMIC-TYPE atmosphere gas producer may have a wide range of operation by adjustment of the air-fuel gas ratio. Here the reaction chamber is shown at *A* and the instrument panel at *B*

periods ranging from two to ten days.

Before starting to dry out a furnace, it should be tested for air leaks and atmosphere tightness. Then, during the drying process, an atmosphere gas should be introduced to carry out water steamed from the brickwork. In the later stages of drying, the atmosphere gas should be free of CO_2 and H_2O; it will penetrate the brickwork and carry out moisture otherwise difficult to remove.

Once the furnace is dry, maintain this condition by continuous operation at working temperature and with the proper atmospere. A temporary shutdown, as over a weekend, may require an operating period of 24 to 48 hr to recondition the furnace to the desired dewpoint.

CARBON POTENTIAL OF GAS

20. There are several methods[8] for checking carbon potential and/or the results on test specimens or the work. In most cases, test specimens are utilized rather than workpieces.

Four methods commonly employed for testing the carbon potential or decarburization or carburization of steel specimens are: (1) the weight-change test, (2) carbon analysis, (3) photomicrographs, and (4) the hardness test. No one of them gives all the information desired. Sometimes two or more tests are used to complete the information needed or to check one against the other. If only one method is used, the weight-change test is generally preferred.

WEIGHT-CHANGE TEST

Only a sensitive balance is required for weighing test specimens. Results can be plotted and compared quantitatively, using different steels, atmosphere gases, periods of time, and temperatures. Disadvantages of the weight-change test are: Samples must be so treated to remain bright or very lightly oxidized—scale or foreign material will introduce appreciable errors; and the results do not show the depth of decarburization or carburization.

In comparing the weights before and after treatment, a loss in weight indicates decarburization, and a gain in weight indicates carburization, assuming that there has been no scale or foreign material on the parts at any time during the test. The specimens must be very carefully weighed in grams to the fourth decimal place (0.0001 gram). To compare one specimen with another, the difference in weight of each specimen is divided by its total surface area in square centimeters, giving a figure which represents the loss or gain in weight per square centimeter of surface exposed to the protective-atmosphere gas. This puts the values of all samples on the same basis, and the results can be shown in tabular form, or they can be plotted as curves showing the weight change compared with differences in carbon content of the samples, time at temperature, or various temperatures for a given time.

Size, surface finish, and cleanliness of specimens treated are important. When using bar stock, specimen diameters range from $\frac{3}{8}$ to 1 in. and lengths from $1\frac{1}{2}$ to $\frac{3}{4}$ in. Strip stock can be used, generally formed in a V section. Surfaces of the specimens should be smooth and bright. Decarburized skins should be removed by machining or prior grinding. Cleaning of samples with carbon tetrachloride, alcohol, or lacquer thinner is recommended, and they should be thoroughly dried prior to weighing. Bar- or strip-type specimens are placed on an alloy tray or alloy

hearth with line contact to provide maximum surface exposure to the atmosphere.

Maximum allowable loss or increase in weight depends on the user's requirements. Gonser[4] has set −20 to +50 grams per sq cm × 100,000 as a generally acceptable range. Decarburization beyond this lower limit may not be permissible on thin stock (such as that used for springs) because of its effect on the total carbon content and ultimate physical properties of the product. Greater values of decarburization might be permissible on heavier stock if wear resistance is not the prime objective. The relatively high tolerance on the carburizing side is generally acceptable, because slight carburizing seldom affects adversely the physical properties. When comparing results of the weight-change test with photomicrographs, it will be found that ±20 grams per sq cm × 100,000 is generally too little to be observed with the microscope.

Carbon Analysis

Carbon potential of a protective atmosphere can be determined with specimens of low-carbon steel shim stock approximately 0.010 in. thick. These specimens are heated for 45 to 60 min. in protective atmosphere. Absorption and diffusion of carbon will take place throughout the specimen until equilibrium is established with the protective atmosphere. The carbon content, as determined by analysis, will be equivalent to the carbon potential of the atmosphere gas.

Another method is to use specimen bars of the analysis of the steel being studied. The method involves turning bars to remove mill decarburization, to ¾ to 1¼ in. dia and lengths of about 5 in. Specimens are treated in the protective-atmosphere furnace. Samples for carbon analysis are turned off in layers, each layer being 0.002 to 0.010 in. thick. The specimens should be machined dry, free from oil, and the chips allowed to fall on clean paper. Carbon analysis is made of chips from each layer. The test is continued until the chips show the same carbon content as the core of the bar. If the specimens have been hardened by the heat treatment, they must be annealed in inert atmosphere to improve their machinability. Time at temperature should be kept to the minimum to prevent diffusion of carbon within the steel.

Advantages are: Total depth and degree of decarburization or carburization, and amount of carbon lost or gained, are accurately shown. Results can be plotted and compared, using different steels, atmospheres, times, and temperatures. Effects of atmospheres or constituents other than carbon can be studied. Accurate results can be had under conditions that sometimes limit use of other methods. Disadvantages include: The tests take time and special equipment, require technicians for analyses, and are relatively expensive.

Photomicrographs

Photomicrographs provide a photographic record of the effects of protective-atmospheres gases on the steel. They can be used to augment and confirm other types of tests or to give results when other methods cannot be used. Disadvantages are: They lack sensitivity for checking small amounts of decarburization or carburization; curves cannot be plotted to compare results; tests take considerable time and special equipment, require technicians, and are relatively expensive. Furthermore, photomicrographs do not always give a true indication of the effects on the samples, and misleading conclusions can be made regarding decarburization or carburization. If the specimens being studied have been hardened or hardened and tempered, they will require annealing to obtain best structures for microscopic examination.

Also, photomicrographs of hardened or hardened and tempered specimens cannot be depended upon to give a true picture of the state of decarburization or carburization. Sometimes they will falsely indicate no change in carbon content at the surface. If specimens are to be studied by means of photomicrographs, and if they have been hardened or hardened and tempered, it is recommended that they subsequently be annealed in an inert atmosphere such as purified nitrogen before they are mounted and polished for making photomicrographs. Or, if a protective atmosphere is to be tested with new, untreated samples, annealing rather than hardening is recommended, preferably slow-cooling the specimen in insulating powder following the heating period.

Hardness Test

Hardness tests can be made easily, quickly, and inexpensively, and equipment is commonly available. Disadvantages are: The results cannot be plotted for comparison; the results are the least accurate and reliable of the four tests. On some types of steel even carburization may cause a soft skin. This makes confusion as to whether the effect is actually carburization or decarburization; and decarburization or carburization may take place to such a degree that the hardness value is not affected. Hardness of steel is affected by temperatures and quenching rates. With low hardness values it is sometimes doubtful whether the results are due to these factors or to actual decarburization.

Hardness Tester

Hardened-steel parts are generally tested by using a weight in the machine to give values on the Rockwell C scale. Serious decarburization may show up in low Rockwell readings on the surface of the steel; by taking subsequent cuts from the steel, gradually increasing hardness values are obtained. When readings fail to increase with additional cuts, it can be assumed that maximum hardness has been reached.

A more common method is to use a lighter weight for obtaining Rockwell 15N "superficial" hardness readings on thin soft skins. These values are converted, by means of a chart, to those normally obtained with the C scale. Actual tests are also made for C-scale readings. Comparison of the converted values with the actual C-scale values indicates decurburization or carburization, depending upon whether the converted values are lower or higher than the actual C values. The comparative hard-

ness test will not, of course, be of value on steels which develop a soft skin with either decarburization or carburization, or on specimens in which the surface hardness is not materially affected by decarburization or carburization.

File Test

This method affords quick easy check of steels that normally become file hard on heat treatment, rather than a final determination, and sometimes shows a soft skin not indicated by other tests. Interpretation of the results depends upon the experience and ability of the individual making the test. File manufacturers offer specially made test files. Other types of tests give more substantial evidence of decarburization or carburization.

WATCH THESE FACTORS

A. Steel parts to be hardened should be checked for surface decarburization before treatment: If the carbon concentration is low at the surface, proper hardening may not be obtained.

B. Ordinarily the temperature should be the lowest that will produce the proper hardness or the characteristic desired. The higher the temperature, the higher must be the carbon potential to prevent decarburization.

C. Time at temperature should be as short as possible to prevent decarburization (or carburization), unless the atmosphere carbon potential is perfectly balanced to that of the steel. In the gas-carburizing process, time must be allowed for the carbon to penetrate the steel to desired depth and concentration.

HOW TO TAKE GAS SAMPLES FOR ANALYSIS

A sample of atmosphere gas, as produced, is usually easily collected. Generally, however, it is also necessary to obtain a sample direct from the furnace chamber for properly determining furnace conditions. For taking samples from inside a furnace chamber, the following suggestions are given:

21. When a portable gas analyzer is placed near the sample outlet, the gas sample can be taken directly into the burette through a rubber tube. If the gas to be sampled is not under slight pressure, purge the sample tube with an aspirator bulb.

When the gas sample must be taken to a laboratory-type measuring burette, a sample bottle is used. This can be a glass or metal container of about 200-cc capacity. Each end terminates with a stopcock and nipple connection. Fill the bottle with clean water. Remove all air bubbles, even to the nipple tip.

Place the rubber tube, from which the sample gas is escaping, over a nipple of the bottle. Open the stopcocks, allowing the water to run out and be displaced by the gas. Shut off the bottom drain cock while some water remains in the sample bottle to assure no infiltration of air. Then shut off the top cock, disconnect the bottle, turn the bottle over, and allow a part of the remaining water to run out and fill cock and nipple through which the sample entered.

TO TAKE A SAMPLE

To get a representative sample, insert a ¼-in. ID quartz or ceramic tube into furnace chamber at a point not close to an atmosphere inlet. Allow atmosphere entering furnace enough time to adjust itself to furnace conditions.

When taking samples for dewpoint measurements, be certain that all tubing and the instrument and its connections are at a temperature above the dewpoint of the gas being tested.

HOW PROTECTIVE ATMOSPHERES AFFECT HEATING UNITS

metallic resistor alloys

GREEN ROT

Nickel-chromium and nickel-chromium-iron alloys subjected to high temperatures in air form self-protecting oxide coatings. Some of atmosphere gases, however, destroy this protective oxidation and corrode certain alloys.

One of the most common effects is known as "green rot[5]." This is believed to be intergranular oxidation of the chromium content of the alloy. Penetration occurs at a fairly rapid rate, completely destroying, in a matter of months, a heating unit that may last five to eight years when operated in an air atmosphere at the same temperature. The 80 Ni-20 Cr material is most susceptible at 1850 F, but the temperature range for attack is about 1650 to 1850 F. Rich exothermic gas produces the most rapid green rot, although wet endothermic gas is almost equally severe. Atmosphere gases which are maintained within the furnace in a comparatively dry condition have shown very little attack.

Resistor material of the 35 Ni-18 Cr series (Type 330 stainless) is resistant to green-rot attack when the silicon content is at least 1.25%. This material, therefore, is commonly used for heating units which are to be operated within the critical temperature range most of the time.

A general recommendation, then, for operation in protective atmospheres is as follows: 35 Ni-18 Cr material for furnace temperatures up to 1900 F and 80 Ni-20 Cr material for furnace temperature above 1900 F.

SULFUR

Sulfur is very corrosive to high-nickel alloys[6]. Most atmosphere gases, as produced, are well below the maximum allowable sulfur content (for reasonable heating

unit life) of about 25 grains per 100 cu ft, owing to low sulfur content in fuel gas.

Many protective-atmosphere gases contain hydrogen, which reacts with sulfur in the furnace to produce hydrogen sulfide — the most corrosive sulfur-bearing gas. Consideration, then, must be given to prevent the introduction of sulfur into the furnace. For example, high-sulfur cutting oils should be removed before the work enters the furnace. Refractories and insulating materials should have low sulfur content. When sulfur contamination of the atmosphere must be tolerated, the low-nickel alloy, 35 Ni-18 Cr, will give maximum life.

CARBON PICKUP

Metallic resistors of high nickel content absorb carbon very slowly, even when exposed to an atmosphere gas with a high carbon potential. At unit temperatures up to 1750 F, such a material may become brittle in time owing to carbon absorption, but this generally does not decrease its effectiveness as a heating unit.

At furnace temperatures of 2050 F, however, as in copper brazing, an atmosphere gas with a carbon potential sufficiently high to prevent decarburization of 0.80% carbon steel may rapidly increase the carbon content of the resistor material from a normal of 0.07 to as high as 2.0% carbon. This increase in carbon content of the resistor alloy slightly reduces its hot electrical resistance and lowers its melting point. These possible changes must be considered in the design of the heating units and provision of accurate temperature control.

Silicon carbide resistors operated at a surface temperature over 2500 F in gases containing 10% or more hydrogen will have greatly decreased life. Otherwise, the normal life expectancy may compare favorably with that of a resistor operating in an air atmosphere. The furnace temperature is of course somewhat less than the resistor temperature.

BURN OFF THE CARBON

Atmosphere gases with a reasonably high carbon potential can be used satisfactorily with silicon-carbide resistors. Excessive free carbon, may result in trouble. In addition to possible electrical short-circulating along the walls between terminals, free carbon may cause a decrease in the electrical resistance of the units, with a corresponding increase in resistor temperature and an increased load on the transformers and power control panels. Exposing the hot resistors to air will burn off the carbon.

HOW ATMOSPHERE GASES AFFECT THERMOCOUPLES

Definite precautions must be taken in the selection of the type of thermocouple (see Table II) and the method of installing it in the furnace, if you expect to get reliable temperature readings.

IRON-CONSTANTAN

These thermocouples may be satisfactory at temperatures up to 1400 F, as long as the iron does not change its carbon content. A low-carbon iron is used, subject, therefore, to carburization which will change the calibration. Iron-constantan thermocouples are not recommended for long service in direct contact with rich exothermic atmospheres in the high-temperature ranges, because sufficient carbon will be absorbed to cause a low reading after a time.

CHROMEL-ALUMEL

Although chromel-alumel is an excellent couple when used in oxidizing atmospheres, it is badly attacked by reducing atmospheres. It is particularly susceptible to attack by wet hydrogen and carbon monoxide which affect the chromel wire, oxidizing the chromium as described under "green rot," causing it to disintegrate in time. This attack is quite rapid, as indicated by curve 1, accompanying figure.

Placing the chromel-alumel couple in a protection tube is common practice. However, this can also lead to trouble. Curves 2, 3, 4, 5, and 6 show the error produced in 14-gage chromel-alumel thermocouples protected by several different materials and exposed to rich exothermic gas at 2000 F. All of these materials are penetrated rapidly enough to throw the thermocouple off calibration in a fairly short time.

Since the chromel-alumel couple retains its calibration in air, it is necessary, when a protection tube is used, to be certain that the open end is not sealed and that the tube is large enough for good circulation of air to carry off or to neutralize gases which leak through

table II . . **THERMOCOUPLES IN MOST GENERAL USE**

Type of Thermocouple	MAXIMUM USABLE TEMPERATURE In Air		In Protective Atmospheres		
	Bare* F	Inclosed+ F	Bare* F	Protection Tube‡ F	Inclosed† F
Iron-constantan	1300		1400	1400	
Chromel-alumel	2100			1400	
Platinum-platinum rhodium		2800			2800†
Nickel-nickel molybdenum		2100			2100

* A bare thermocouple is one which is exposed at the hot end.

\+ An inclosed thermocouple is one which is built into a tube that is tightly closed at both ends.

‡ A protection tube is a tube through a furnace wall, in which a thermocouple is inserted. The tube is closed at the hot end, and is usually open at the cold end, or at least is not tightly closed.

† Will go off calibration at high temperatures unless air or nitrogen is bled into protection tube.

the tube. Thus, a protection tube placed in an inverted vertical position would not ventilate readily and would be a source of trouble. One method that is employed is to force a very small flow of air into the open end of the protection tube to provide purging action.

PLATINUM-PLATINUM RHODIUM

The platinum-platinum rhodium thermocouple works best in an air atmosphere. Hydrogen causes it to drift off calibration; however, other protective-atmosphere gases do not seem to affect it. This couple is normally made of fine wire, which is inclosed in a Sillimanite tube. For protective atmospheres, a second and larger Sillimanite tube is used for added protection. Curve 5 in figure indicates that Sillimanite is not completely impervious to H_2, but experience shows that the double-tube protection gives satisfactory results. A customary procedure in maintenance of "platinum" thermocouples used in protective-atmosphere furnaces is to remove them periodically, say every three months, and "flash" them in an air-atmosphere furnace for about 5 min at about 2400 F. This generally corrects the drift from calibration.

NICKEL-NICKEL MOLYBDENUM

Because of the effect of gases upon common thermocouple alloys, a more reliable material was sought. Research brought forth the nickel-nickel molybdenum combination. One wire is pure nickel; the other is 18% molybdenum nickel alloy. These materials have a limited life in air because of oxidation, but they are not affected by reducing atmospheres. To overcome the effect of oxygen and allow the couple to be used in either air or gas, the element is placed in a closed-end protection tube with the terminal end sealed hermetically by glass.

This type of thermocouple will operate for long periods in hydrogen-bearing atmospheres at high temperatures without going off calibration. Curve 7 in figure shows how the "nickel-nickel moly" couple gave constant readings during the period of the test.

General considerations in use of thermocouples in protective gas atmospheres are:

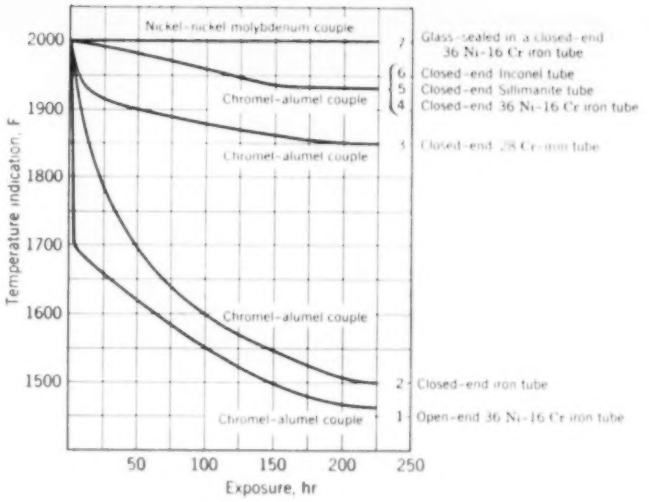
1. Practically all changes that take place in a thermocouple material will cause a decrease in the millivoltage output. Actual temperature in the furnace will then be higher than that indicated by the instrument.

2. Chromel-alumel couples should be placed in ventilated protection tubes. Above 1400 F, nickel-nickel molybdenum is superior.

3. Small-diameter wire changes calibration must faster than larger-diameter wire.

4. The rate of change in calibration increases as the hydrogen content of the gas atmosphere increases.

5. High temperatures also increase the rate of change in calibration.



LOW READINGS of a chromel-alumel thermocouple can occur in a short time, even though placed in a protection tube of various materials, if exposed to rich exothermic gas at 2000 F. Better practice is to purge the tube continuously with air—better yet to use a high-nickel molybdenum, platinum-platinum rhodium thermocouple or a radiation-type thermocouple

CARBON MONOXIDE AFFECTS REFRACTORIES

Protective-atmosphere gases containing CO may, under some conditions, cause rapid and serious disintegration of brickwork.[1, 2]

When an atmosphere gas containing CO is free of CO_2 and low in H_2O, it is unstable and needs only the promoting effect afforded by a catalytic surface to cause a rapid reaction to take place. The importance of iron as a catalyst must be considered.

Most firebrick clays contain small quantities of iron in some form of oxide. This iron may become the catalytic agent for the gas reaction. Since the gas penetrates the brick, carbon growth take place inside the brick. The expansive force of the carbon growth is so great that the brick can be completely fractured.

Illustrated are samples of three standard brands of hard-burned firebrick, *A*, *B*, and *C*, treated for 24 hr at various temperatures in protective atmosphere high in CO content. The gas analysis was 45% H_2, 20% CO, 0.5% CH_4, 34.5% N_2, dewpoint zero F. Samples 1, 2, and 5 were brand *A*, samples 3, 4, and 6 were brand *B*, and sample 7 was brand *C*. No reaction was noted in any of the brands below 700 F or above 1200 F.

Sample 1, Brand *A*, at 700 F

IRON IN FIREBRICK, if in the proper form, promotes internal carbon growth, which often destroys the brick

DARK COLOR, indicating a temperature of 2500 F or more when firing the brick, is indicative of ability to resist breakdown in protective atmospheres containing a high percentage of carbon monoxide

showed slight cracks and small carbon deposits. Sample 2, brand *A*, at 800 F cracked up in large pieces. Sample 3, brand *B*, at 900 F crumbled to the point of complete destruction, and small black carbon deposits were readily visible. Sample 4, brand *B*, at 1100 F had large cracks and came apart. Sample 5, brand *A*, at 1100 F had a large crack through the center, but it held together. Sample 6, brand *B*, at 1200 F showed no cracks, although this is the brand that crumbled completely at 900 F. Sample 7, brand *C*, withstood repeated treatments with each of the foregoing samples and at higher temperatures, over a range of 700 to 1800 F. It withstood the treatments without physical change.

The difference in these three brands of bricks is due to the form in which the iron is present.

If the bricks are used in neutral or oxidizing atmospheres, however, the form in which the iron appears is immaterial, and any of the bricks shown are satisfactory.

FIRING TEMPERATURE FOR BRICK

The normal firing temperature of standard firebrick is 2500 to 2700 F. However, depending upon the type of kiln and the position of the brick within the kiln, some brick may not reach the minimum temperature of 2500 F. Light-colored brick indicate insufficient firing temperature, say 2300 F, whereas dark-colored brick, fired at 2500 F, is satisfactory. This color characteristic is, in general, an indicator of the suitability of a firebrick for use in high-CO protective atmospheres at low temperatures.

Insulating-type firebrick containing iron oxide may be similarly affected, but only to a limited extent and disintegration is not so rapid, because of the porous structure of the brick.

In general, where dry, high-CO gases are to be employed in contact with the brickwork, a refractory of very low iron content is desirable. This not only prevents carbon deposit; it also aids in shortening the time required to obtain a dry gas condition in the furnace. The small amount of oxide reduction which takes place in the brick minimizes the formation of water vapor.

Reducing atmospheres also affect the strength of refractories. Brick under load will deform at lower temperatures in reducing gases than in air atmosphere.

Tests have shown the degree of deformation increases markedly with the iron content of the refractory. A rule-of-thumb method for selecting insulating refractory brick for use in reducing gas atmospheres is to set a maximum temperature rating of about 300 F below the temperature rating published for air atmospheres.

EFFECTS OF CARBON MONOXIDE ON PERSONNEL

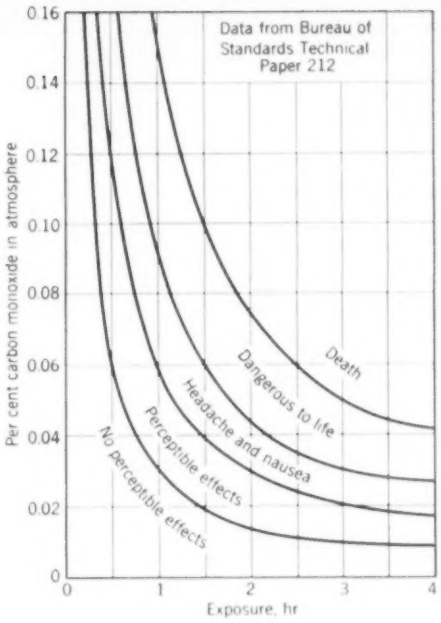
Because carbon monoxide (CO) is colorless, odorless, tasteless, and nonirritating, a person who might inhale air contaminated with CO receives no warning of its presence and, therefore, should be acquainted with symptoms affecting him.*

As shown by the accompanying chart a comparatively small concentration can have a marked effect on a person. Safe concentrations are less than 0.01%. A concentration of 0.02% may produce a headache, mental dullness, and physical loginess, in less than 2 hr. A concentration of 0.06% CO may produce headache in about 1 hr and unconsciousness in 2 hr,

and 0.10% CO may produce the same effect in one-half the time and be fatal in an exposure of 1½ hr.

Personnel in the immediate vicinity of a furnace or other equipment using an atmosphere containing CO should be warned to watch for such symptoms as drowsiness, headache, and nausea, and when such symptoms are noted they should leave the area at once and report the condition to the proper authorities.

Simple and inexpensive testing equipment[10] is available for detecting CO and warning of its presence. The proper installation of equipment and methods of handling of gases will prevent troubles of this nature.



CARBON MONOXIDE is dangerous to personnel in even low concentrations in air. Simple and inexpensive warning devices or detectors may be installed in the vicinity of a furnace using a protective atmosphere containing CO

effects of hydrogen on steel

HYDROGEN EMBRITTLEMENT

It has long been known that steel can be damaged by hydrogen absorption.[11, 12] Exposure to H_2 under conditions favorable to absorption can occur during cleaning operations such as pickling, and during heat treatment in H_2-bearing gases. The manner in which the damage is effected, the exact conditions causing the damage, and the method of recovery of embrittled steels have been largely unexplained.

FROM PICKLING

Recent studies on brittleness caused by pickling have produced new data. A microscopic view of the embrittlement process is presented by Zapfee[13] in an attempt to simplify the understanding of the manner in which hydrogen embrittles steel. Data and charts in the text present the following conclusions:

1. Steel is much more susceptible to embrittlement when in a hardened condition.
2. Cold working further increases the susceptibility of steel in any condition.
3. Embrittlement increases with pickling time.
4. The type of acid used makes very little difference.
5. Increased pickling bath temperature increases brittleness effect.
6. Hardenable stainless steels are much more susceptible to embrittlement than SAE steels with the same carbon content.
7. Contrary to previous theory, commercial inhibitors increase rather than decrease embrittlement beyond that caused by the raw acid.

QUENCH CRACKING

Hydrogen absorption from atmosphere gas may take place at elevated temperatures as used for annealing or hardening. The penetration is apparently sufficient and the force exerted great enough to start surface cracks.

Leidholm[14] reports that on production work in hardening propeller blades an epidemic of quench cracking was shown to be due to the use of wet endothermic gas atmosphere which is inherently high in H_2 (35 to 50%).

table III . . QUENCH CRACK SENSITIVITY TESTS*

Effect upon quench cracking of a time delay between removal of the sample from the furnace at 1700 F and plunging into water quench when H_2 atmosphere gas is used

Material	Carbon %	Seconds Delay 0	30	60	90	120	150	180	R, Min Max	H, %
CPS 4524†	0.33	3/3‡	—	—	—	4/4	—	0/3	——	100
CPS 4524	0.32	—	2/2	2/2	2/2	1/1	1/1	0/1	——	100
CPS 4524	0.32	—	2/2	2/2	1/2	—	2/2	0/2	——	100
CPS 4524	0.32	—	2/2	2/2	2/2	0/2	0/2	—	——	100
CPS 4524	0.31	—	2/2	2/2	1/2	1/2	0/2	—	——	100
CPS 4524	0.31	—	2/2	2/2	2/2	1/2	0/2	—	——	100
CPS 4524	0.30	—	1/2	2/2	1/2	0/2	0/2	—	——	100
CPS 4524	0.27	—	2/2	2/2	1/2	0/2	—	—	51/52	100
CPS 4504†	0.22	—	1/2	0/2	0/2	—	—	—	——	100
CPS 4504	0.16	0/1	0/2	0/2	0/2	—	—	—	43/44	100
CPS 4524	0.33	0/4	—	—	—	0/4	—	0/2	——	8.5

* From *Metal Progress*[15].

† CPS 4524 steel is similar to SAE 4330.

‡ The digit to the left of the shilling mark shows the number of specimens cracked, and the digit to the right denotes the number of specimens tested.

† CPS 4504 steel is similar to SAE 4320.

CHECK SHEET FOR TROUBLES AND CURES IN OPERATION

FOR APPROPRIATE TESTS SEE NUMBERED PARAGRAPHS IN TEXT

I. When nonferrous metals discolor within the furnace and it is desired to have them emerge as bright as possible: — TEST

Determine type of discoloration:

- Oxide — 1
- Sulfide — 1, 4
- Zinc distillation
- Carbon

A. If oxide, look for:

1. Air leaks. Investigate and repair:
   - *a.* Pipe connections.
   - *b.* Stuffing boxes.
   - *c.* Gaskets. — 12-15
   - *d.* Pitch seals or sand seals.
   - *e.* Doors, for warpage.
   - *f.* Retorts — 7-10
   - *g.* Sufficiency of atmosphere gas supply. — 16
2. Drafts of air in room: — 16
   - *a.* Close doors and windows.
   - *b.* Increase or adjust flow of gas to the heating and cooling chambers, if possible, to counteract drafts.
   - *c.* Install screens at ends of furnace to block drafts.
   - *d.* Remodel hoods over doors if necessary.
   - *e.* Adjust dampers in flues from door hoods.
   - *f.* Induce draft in one flue.
   - *g.* Check adjustment of gas curtains.
   - *h.* Install charging and discharging vestibules on furnace, with gas-tight inner and outer doors. — 15

B. If sulfide investigate:

1. Purity of gas: — 2
   - *a.* Entering gas producer.
   - *b.* Entering furnace (should be sulfur-free).
   - *c.* Within furnace (should be sulfur-free).
2. Brick, mortar, and insulation: — 3
   - *a.* By heating sample in hydrogen
3. Lubricants on work (should be sulfur-free): — 3

C. If zinc distillation, investigate:

1. Temperature:
   - *a.* Use minimum.
2. Time at temperature:
   - *a.* Use minimum.
3. Moisture and CO_2 content of gas:
   - *a.* Use minimum.
4. Zinc vapor pressure:
   - *a.* Sinter brass parts under metal covers if necessary.
5. Hydrogen content of atmosphere:
   - *a.* Use maximum.

D. If carbon, investigate:

1. Lubricants on work entering furnace:
   - *a.* Should be completely volatile type
   - *b.* Should be removed if non-volatile.

II. When nonferrous metals emerge from cooling chamber bright, but discolor in air:

Determine type of discoloration:

- Oxide from being too hot — 1
- Sulfide from sulfur in room air — 1, 4

A. If oxide, check temperature of outgoing work, and if too high, try to: — TEST

1. Increase flow of water through furnace cooling chamber.
2. Slow down rate of travel of work to allow more cooling time.
3. Diminish heat developed by flame curtain if used at the discharge opening:
   - *a.* Reduce fuel-gas flow to curtain.
   - *b.* Move work faster through curtain.
   - *c.* Shut off gas flow to curtain and pilot to eliminate flame; also reduce door opening to a minimum.
   - *d.* If protective atmosphere gas is flammable, shut off gas flow to the curtain, leaving pilot burning. Raise discharge door and allow idle flame of atmosphere gas to burn back into throat.
   - *e.* Replace flame curtain with asbestos or glass cloth curtains.
4. Check furnace cooling chamber for presence of lime, scale, or mud in the water jacket. Clean out if necessary.

B. If sulfide, check room air for sulfur contamination. — 4

III. When ferrous metals discolor within the furnace:

Determine type of discoloration:

- Oxide — 5
- Carbon

A. If oxide, look for:

1 and 2. See Section I, part A.

3. Water in furnace cooling chamber:
   - *a.* Condensation: — 17
     - (1) Try reducing flow of cooling water.
     - (2) Try automatic control of cooling water in first cooling zone.
     - (3) Try reducing moisture content of atmosphere gas. See 4*a* below.
     - (4) Try water recirculating pump(s).
   - *b.* Leaks: — 18
     - (1) Welded joints.
     - (2) Rusted-through spots.
     - (3) Porosity in cast housings for water-cooled bearings for rolls and fans.
4. Moisture in gas atmosphere. Check:
   - *a.* Performance of surface cooler of atmosphere-gas producer:
     - (1) Check temperature of cooling water.
     - (2) Clean condensing tubes if needed.
     - (3) Try increasing flow of cooling water.
     - (4) Look for water leaks in tubes or header.
     - (5) Look for condensate in gas lines from atmosphere producer to furnace.
     - (6) Check for proper operation of condensate trap.
   - *b.* Water-spray or iron-oxide tower too close to some source of heat.

OF PROTECTIVE-ATMOSPHERE FURNACES

5. Improper input air-gas ratio to atmosphere gas producer:
   a. Try lower ratio.
6. Air carried in with work: 5, 6
   a. Purge large vessels and long coiled tubes.
7. Air or water in quenching oil. 5, 6

B. If carbon, investigate:

1. Lubricants on work entering furnace:
   a. Should be completely volatile type.
   b. Should be removed if unable to use volatile-type.

IV. When ferrous metals emerge from cooling chamber bright, but discolor upon striking the air, because of oxidation:

A. Check temperature of outgoing work and, if too high, try to:

1. Increase flow of water through furnace cooling chamber.
2. Slow down rate of travel of work to allow more cooling time.
3. Diminish heat developed by flame curtain, if used at the discharge opening:
   a. Reduce fuel-gas flow to curtain.
   b. Move work faster through curtain.
   c. Shut off fuel-gas flow to curtain and pilot to eliminate flame; also reduce door opening to a minimum.
   d. If protective-atmosphere gas is flammable, shut off gas flow to the curcurtain, leaving pilot burning. Raise discharge door and allow idle flame of atmosphere gas to burn back into throat.
   e. Replace flame curtain with asbestos or glass cloth curtains.
4. Check furnace cooling chamber for presence of lime, scale, or mud in the water jacket. Clean out if necessary.

V. When medium- and high-carbon metals decarburize in supposedly nondecarburizing atmospheres:

A. Look for excessive water vapor in atmosphere gases entering furnace:

1. In purified (CO_2-free, dry) exothermic gas:
   a. Check temperature of gas leaving absorbing tower.
   b. Investigate effectiveness of refrigerated gas cooler.
   Look for:
   (1) Loss of refrigerant.
   (2) Inadequate cooling-water supply.
   (3) Improper functioning of temperature controls.
   c. Study performance of regenerative-type drier.
   Look for:
   (1) Inadequate reactivating cycle (sufficient time and temperature for both heating and cooling).
   (2) Reduced adsorbing capacity due to accidental overheating or contamination. TEST
2. In endothermic gas, look for:
   a. Inadequate operating temperature.
   b. Excessive input air-gas ratio.
   c. Reduction of hydrocarbon-content in fuel-gas supply.
   d. Reduced effectiveness of catalyst:
   (1) Try removing carbon, when incandescent, with air or steam.

B. Look for excessive water vapor in atmosphere gases within furnace due to: 20

1. Inadequate purging and drying of brickwork.
2. Oxygen carried in with the work:
   a. Air.
   b. Moisture.
   c. Oxides on surfaces of parts.
3. Air leaks. Investigate, and repair if necessary:
   a. Pipe connections.
   b. Stuffing boxes.
   c. Gaskets. 12-15
   d. Pitch seals or sand seals.
   e. Doors, for warpage.
   f. Retorts. 7-10
   g. Sufficiency of atmosphere gas supply 16
4. Drafts of air in room: 16
   a. Eliminate at their source; close doors and windows.
   b. Increase or adjust flow of gas to the heating and cooling chambers if possible, to counteract drafts.
   c. Install screens at ends of furnace to block drafts.
   d. Remodel hoods over doors if necessary.
   e. Adjust dampers in flues from door hoods.
   f. Induce draft in one flue.
   g. Check adjustment and effectiveness of gas curtains. 15
   h. Install charging and discharging vestibules on furnace, with gas-tight inner and outer doors.
5. Water in furnace cooling chamber.
   a. Leaks: see part III, A, 3b. 18

C. Look for CO_2 in atmosphere entering furnace:

1. In purified exothermic gas:
   a. Check CO_2 removing solution (monoethanolamine) for:
   (1) Sufficient flow.
   (2) Proper cooling.
   (3) Sufficient concentration.
   (4) Proper reactivation.
   b. Check for leaking bypass valve at absorbing tower.
2. In endothermic gas, see part V, A, 2.

D. Excessive CO_2 in atmosphere gas within furnace due to:

See Section I, part A.

The same type of work similarly treated in a purified rich exothermic gas showed no tendency to crack. This was further proved by laboratory tests using 100% H_2, as compared to the low H_2 exothermic gas. The results shown in Table III lead to these conclusions:

1. A high H_2 atmosphere produces quenching cracks.
2. A low H_2 atmosphere shows no tendency toward cracking.
3. A definite time delay before quenching permits the H_2 to escape from the steel and reduces the tendency toward cracking.
4. The effect of H_2 absorption upon cracking increases with increasing carbon content.

It must be remembered that these tests were made upon only one type of steel with high hardenability and subjected to drastic quenching conditions.

Zapfee[13] points out that Types 431 and 414 stainless steels are both quite susceptible to embrittlement when processed or annealed in atmosphere gases containing high values of H_2.

WATER VAPOR

Moisture in the furnace atmosphere may also be a source of H_2 embrittlement, particularly when heat-treating stainless steels of the hardenable types.

Zapfee[14] conducted tests with Type 414 stainless steel by hardening samples in atmospheres of dry helium, saturated air, and steam. At about 1800 F the sample heated in dry helium could be bent 180° without breaking. The sample heated in saturated air would break with a 30- to 60° bend, whereas the samples heated in steam were about like glass and would break when bent as little as 10°. In another test, a sample was heated for 14 min. at hardening temperature in dry atmosphere and then exposed to steam for only 1 min. before quenching. The result was a degree of embrittlement equal to that produced by a 15-min. treatment in steam. Further tests indicated increased brittleness due to H_2 from moisture when treating stainless steels of Types 403, 410, 430, and 440. Increasing carbon content rapidly increases the susceptibility to this type brittleness.

RADIATION PYROMETER is used to check furnace temperature, as a cross check on the proper functioning of indicating and controlling pyrometers

WHEN THINGS GO WRONG

In the operation of protective-atmosphere equipments, things sometimes go wrong and undesirable results are obtained. Discoloration of the work being treated in furnaces is the most common ailment, and decarburization is the next. Once the cause of the difficulty is found, correction of it is often a simple matter. To aid in putting a finger on troubles, the Check Sheet (page 166) has been prepared. It is a summary of what to look for and what to try if things go wrong.

Troubles often can be typed and catalogued; some of the more common ones are listed in bold face at the left side of the check sheet. If the trouble is discoloration, for example, it first becomes necessary to decide whether the discoloration occurs within the furnace or outside the furnace. Then the type of discoloration must be determined —that is, whether it is a film of of oxide, sulfide, zinc, or carbon.

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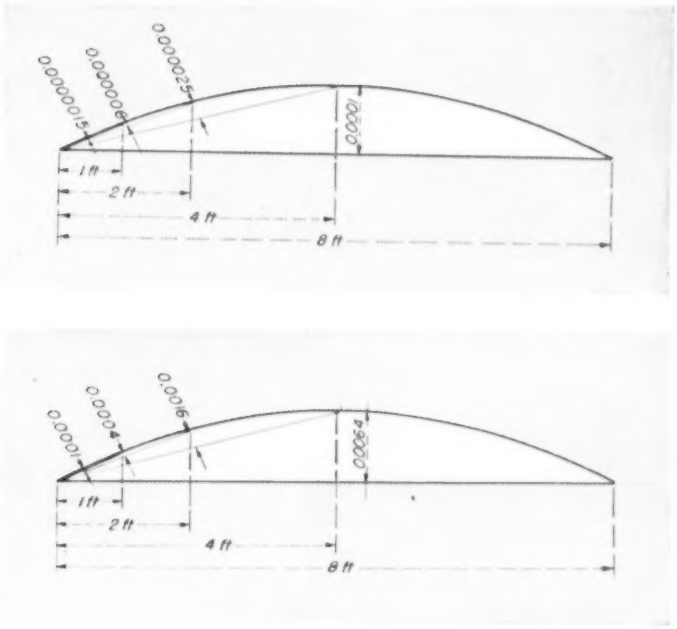
Why don't we standardize surface-plate specs?



Here is offered a start toward standardization on specifications that will allow a user to know what he wants, what he gets, and how good it is when he works with surface plates

BY R. J. RAHN, RAHN GRANITE SURFACE PLATE CO.

Up to a little over ten years ago, there were no definite specifications for accuracy of surface plates. If you required a plate of best accuracy, price no object, you went to manufacturer X. If a plate of less accuracy and better price was wanted, you bought from maker Y. And if you were buying a plate on price alone, your best source was manufacturer Z. The only other sources were mainly local makers with local reputations.

Then granite surface plates appeared, and with them the first specifications for accuracy appeared. However, these only served to confuse the issue. In fact, some of these specifications were plainly fantastic, including those on one price list that included a quote for a 6x12-ft plate specified "accurate to 0.00005 in."

Some time ago, I was asked by a customer to quote a price on an 8-ft plate with an over-all accuracy of 0.0001 in. I said this was impossible, and I drew the accompanying sketch. If the chord height of a uniformly curved plate is 0.0001 in. in 8 ft, then the chord height at 4 ft from one end is a quarter that amount, or 0.000025 in. The chord height at 2 ft is a quarter of that amount, or 0.000006 in. At 1 ft, the chord height is 0.0000015.

I told the customer that we could not check an 8-ft surface plate to 1½ millionths per ft and that I doubted anyone else could, either. He replied that he didn't mean this, but wanted a plate having an accuracy of 0.0001 in. per ft extending all over the plate. Then I drew another sketch and showed how this could allow a maximum error of 0.0064 in. over an 8-ft plate. He said he didn't want that either, and told me to just make the best plate possible.

Then he asked me, "Why doesn't somebody write a specification on accuracy of a surface plate that everyone can understand?"

In answer to this and similar suggestions, we have worked up and are now using the following specifications on granite plates:

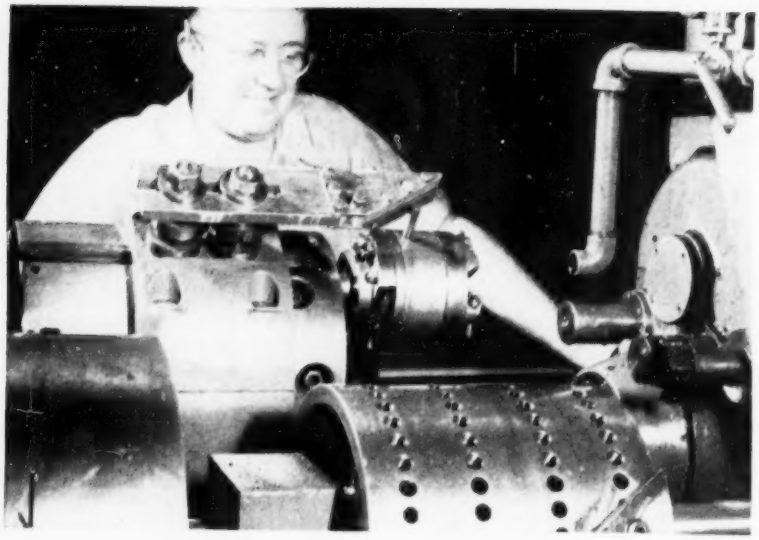
I. All points on the surface shall lie between two planes separated by the distance equal to the specified accuracy.

II. On grade A plates, regardless of size, every 2 sq ft shall be accurate to 0.00005 in. or less, except for an inch or two at some of the edges or corners, which may be bell-mouthed an additional 0.00005 in. On grade B plates, these figures are doubled.

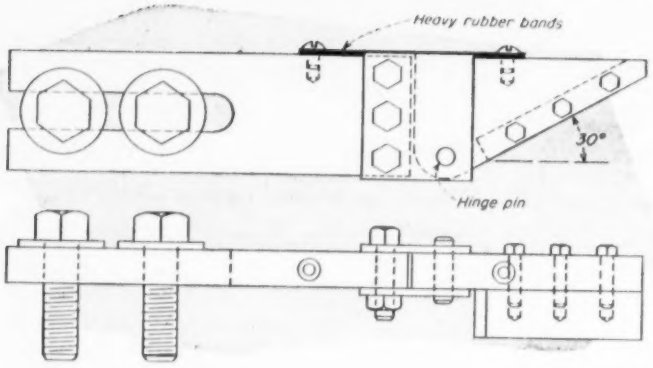
III. Our plates are made in the form of a quite uniform convex arc within the over-all and 2-sq-ft tolerances.

The grade A plate might be called a 0.00005-in. surface plate by some people.

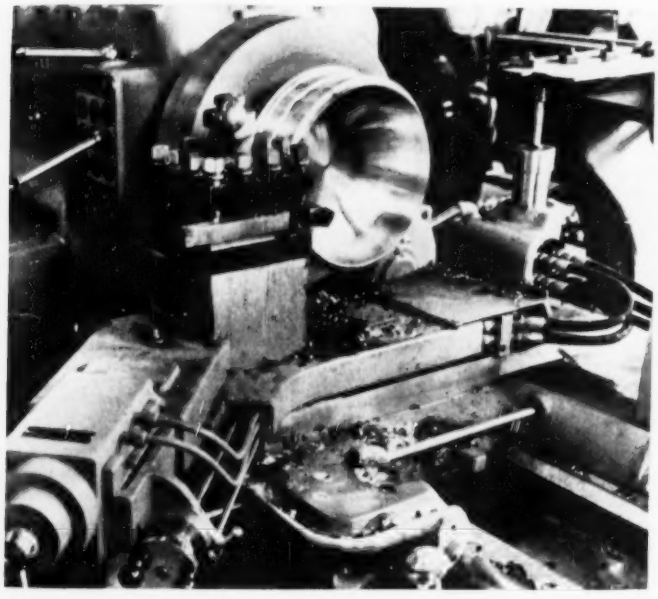
Most use, and greatest wear, generally occurs near the center of a plate, so any early wear will tend to reduce the arc of the plate, and will tend to increase accuracy and give longer service than plates which are concave within the same specified tolerances.

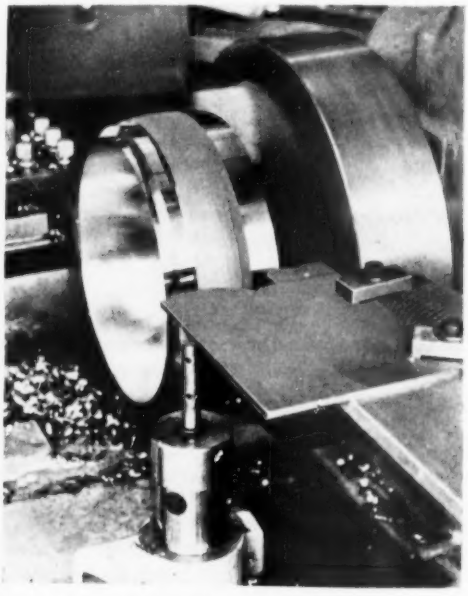


talented tooling

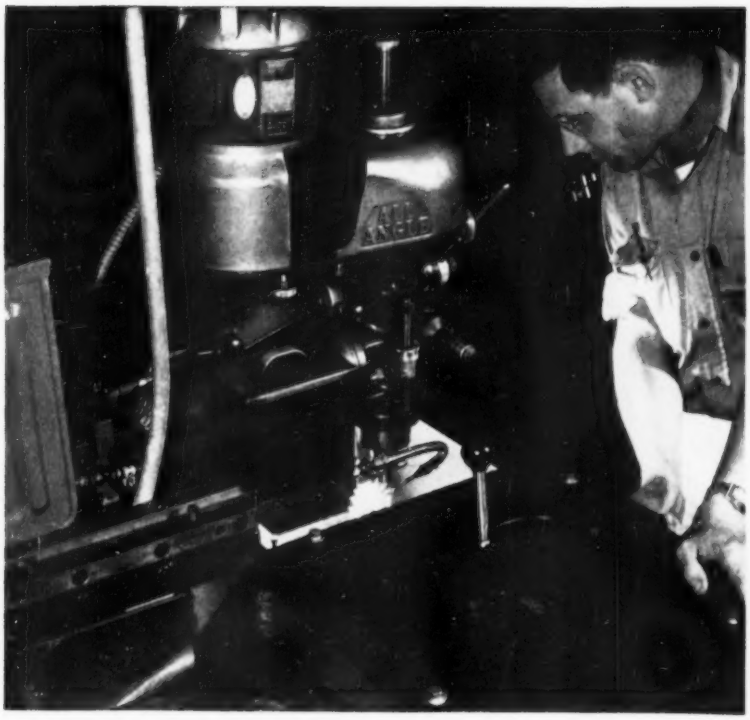


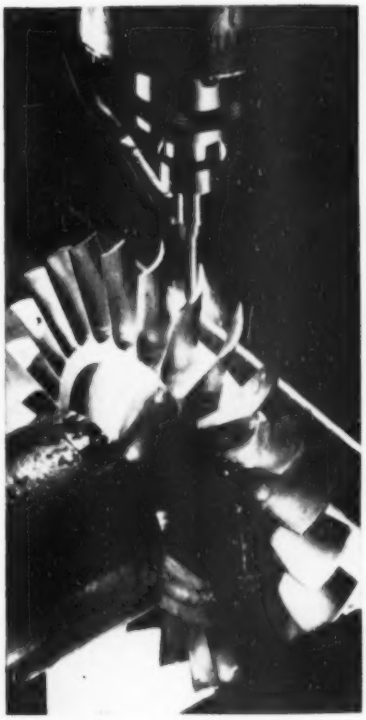
AT ALLIS-CHALMERS, a tangent diehead is closed by a 30° guide attachment bolted to the turret guide ring. Action is now automatic, because each time the turret head slides back, the handle hits the guide and rotates the diehead. Stock worked on is 1¼- and 1⅛-in. brass and hot-rolled steel



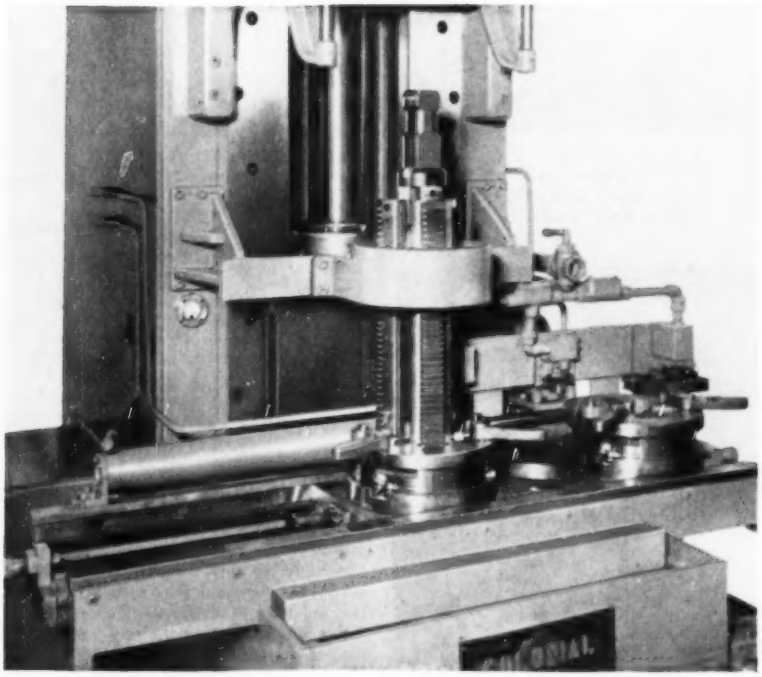


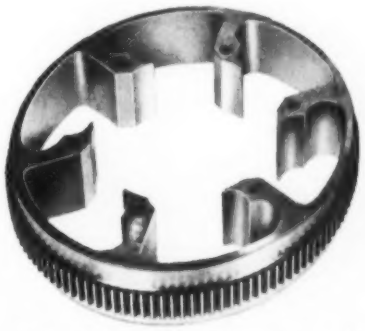
AT RHEEM MFG, 23 lb of 4130 is removed from air-tank-head forgings with Turchan hydraulic follower (rear) guiding cuts on inside and outside diameters. Parts are for guided missiles; take 68 min. machine time. Tolerance is plus 0.005 in. Templet clamped to back slide controls cut on length, inside bore, and radius. Contour inside is straight blended to 2-in. radius blended to 8-in. radius





AT MARQUARDT AIRCRAFT, a shop-designed miller cuts rotor blades for a ramjet engine. The Fray all-angle cutting head works at 1800 rpm to spin an endmill or rotary burr. Indexing, oscillation, and rotation that makes the blade follow a contour curve is done by cabinet full of gearing and templets in front. Finishes to 10-20 mu in. rms are held

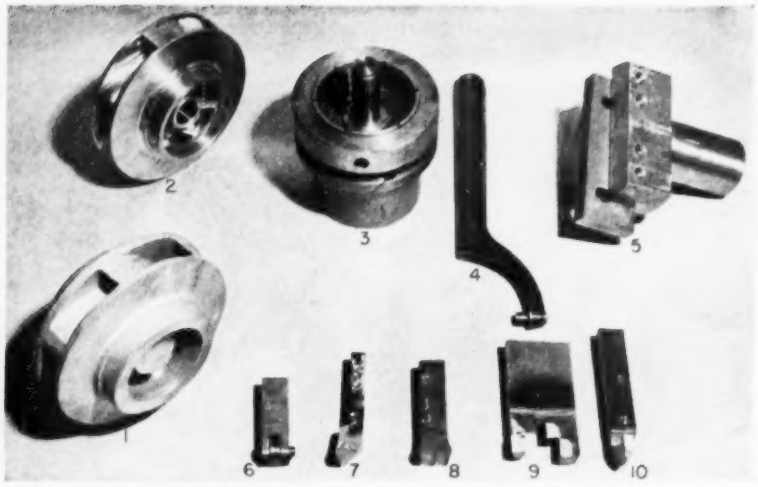




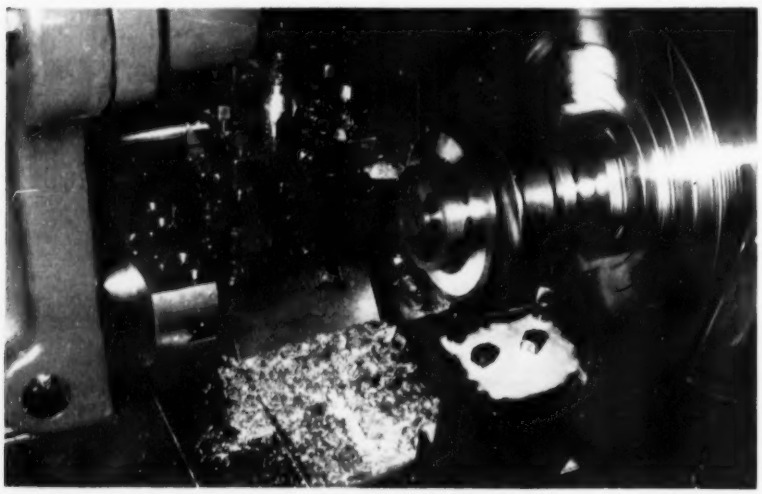
AT COLONIAL BROACH, a built-up tool with inserted tooth sections is cycled automatically to work on aircraft-engine parts loaded in a two-stage shuttling fixture. Six contours between lobes on the part are cut alternately, three at each stage. Guide shoes support and cover the part; the broach is returned to top position through central hole in fixture. Machine is standard 15-ton, 66-in.-stroke model with interlocking switches

Turret Tooling Cuts Taper on Pump Wheel

BY ANDERSON ASHBURN,
ASSOCIATE EDITOR



PUMP WHEEL AND SPECIAL TOOLING required for machining it. Standard tools are not shown. *1*—Rough casting; *2*—finished part machined all over; *3*—special collet chuck; *4*—wrench for chuck; *5*—cam guide for machining taper on housing; *6*—roller follower; *7*—tool for cutting taper; *8*—tool for marking three centerlines; *9*—3-part tool for finish facing; *10*—3-purpose tool

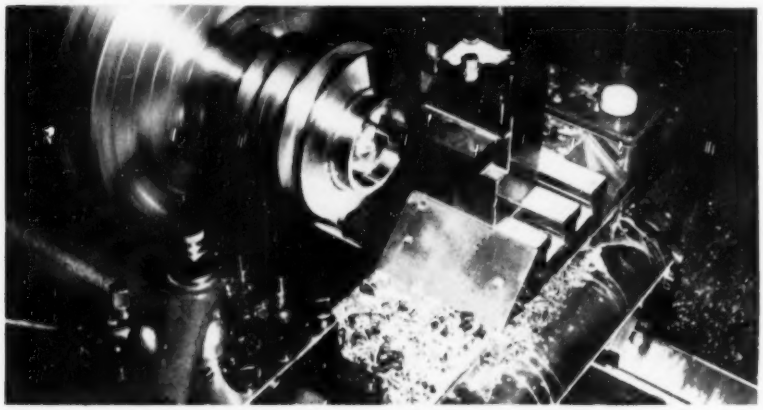


TAPERED SURFACE OF SIDE PLATE is cut with tool guided by cam mounted in hex turret. View from rear of lathe shows tool *7* mounted in one side of square turret and roller follower *6* in the other side. Cam *5* is chucked in one position of hex turret. Form of tool cuts ¼-in. radius at inner end of taper, then as cross-slide traverses tool out from center hub, cam advances cross-slide to cut the required taper

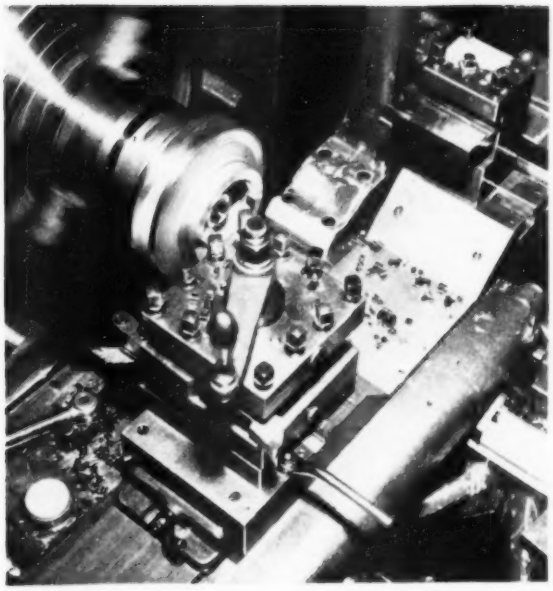
Among several unusual tooling jobs in the turret-lathe department at De Laval Steam Turbine Co, Trenton, is this setup for machining bronze pump wheels all over. Designed for a Herbert No. 8 Preoptive turret lathe, it includes a tapering operation and two cutters that perform three and four operations respectively.

The pump wheel is first mounted in the 4-jaw chuck and, after one side is completed, reversed and mounted in a special collet chuck. The sequence is to finish turn the OD and drill the center hole from the hex turret, rough turn the ring diameter, then mark the centerlines on the OD from the square turret. Next come the special operations described in detail in the captions. The first side is completed by boring and reaming the center hole.

Another unusual tooling setup on the same lathe permits machining a split-steel bearing by holding on a spud arbor with first one, then two rings. This is shown at the bottom of the next page.



THREE CUTTING SURFACES on tool *9* are ground to minometer-set dimensions. Tool first turns the ring diameter to +0.000 —0.002 in., then finish faces three surfaces: the shoulder at the inner end of the side plate, the face of the ring, and the face of the hub



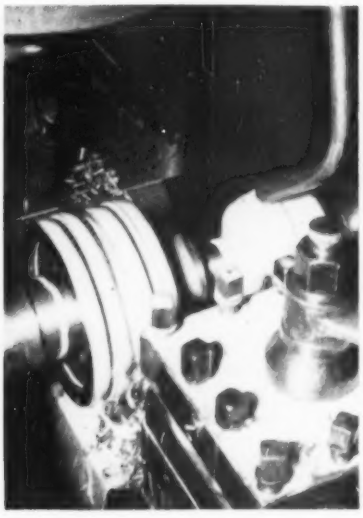
THREE-PURPOSE tool *10*, mounted in the square turret opens up the inlet area inside the ring, then rounds off the hub diameter, and finally chamfers the end of the bore

AFTER ONE SIDE IS MACHINED with pump wheel mounted in 4-jaw chuck, collet chuck 3 is mounted in chuck. Pump wheel is reversed and located on spud arbor in chuck with shoulder located against collet face. Collets are tightened to drive the chuck and all operations except drilling, boring, and reaming of center hole and marking of centerlines are repeated

THREE RINGS SPLIT HOLDING JOB ON BEARING

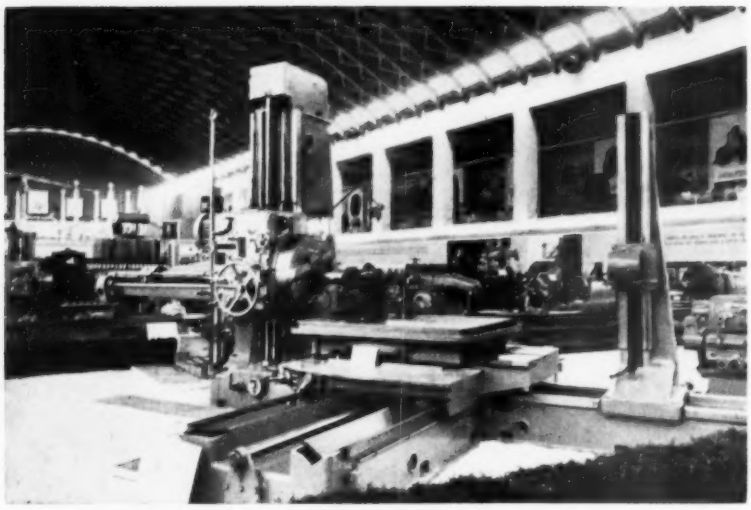
SPLIT-STEEL BEARING lined with babbitt is fitted over spud on arbor of lathe. Spud is about 0.001-in. oversize for press fit but undercut at ends to provide clearance for machining bearing. Wide ring at right is slipped over bearing and four recessed screws tightened to hold it on spud

TAPERED RECESS is cut on each side by tools on rear toolpost at 62 rpm. Coolant was diverted from operation long enough to make picture. Tools are 18-4-1 high-speed steel because it gives smoother cut with less tendency to twist the bearing on its spud. Prior to this operation, babbitt ring was cut off by thin parting tool and salvaged; sides of bearing were faced



TAPERED RINGS are then driven on recesses just cut at each side of bearing and center ring is removed, for final turning cut across outer surface of bearing

Rumania develops machine-tool industry



ONE OF THE LARGE HALLS at the Bucharest exhibition where machine tools occupied a large section. The horizontal boring mill in the foreground was built at the Red Flag factory in Stalin City, the new name for the town of Brasov

By JOHN CARDEW

Formerly one of the most backward of East European countries, Rumania now emerges as a producer of machine tools and a variety of heavy equipment. This provides an interesting comment on the present rate of industrial development in Eastern Europe

LARGEST in Eastern Europe, the Czechoslovak machine-tool industry has been well known to the West since before the war. Rumanian production, however, is of far more recent origin, and an exhibition recently opened in Bucharest has provided Western industrialists with an opportunity to assess the industrial progress made since the country launched its initial five-year plan two years ago.

Pride of place in the exposition was given to machine tools and tractors, and a long and imposing row of lathes, planers, boring mills, milling machines, and presses emphasized concentration on the means of production.

This trend is general throughout Eastern Europe, and a survey made in 1950 estimated that, while machine-tool production in West European countries at the end of 1952 would be about one-sixth above prewar level, production in Eastern Europe would increase nearly six times.

The entire Rumanian machine-building industry is a postwar creation, and is officially described as now being "the leading branch of Rumanian industry." Rumania has, in recent years, built up an industry that already accounts for 60% of the national economy and is to be raised to 63% by the end of this year. Under the one-year plans in 1949 and 1950, and under the present five-year plan (1951-55), over 40% of the total investment in industry has been for means of production, with rising emphasis on machine tools.

Principal machine-tool plants are the August 23 (formerly Malaxa), Vulcan, and New Times plants in Bucharest, which produce automatic lathes, grinders, and planers; the Victory and Iosif Ranchet works in Arad, an important industrial center near the western frontier with Hungary; the Red Star factory in Stalin City (formerly Brasov); and a joint Soviet-Rumanian enterprise in Resita, Sovrommetal. All these plants have been considerably expanded since the war, and a hundred new factories, some of them for machine-tool production, are scheduled for construction before the end of 1955. A new ball-bearing factory, equipped with Soviet machinery and intended to meet all Rumania's needs, was due to be completed in 1952.

During the period of the five-year plan, production is to be concentrated on medium and small machine tools, and high-speed special lathes are to be developed and put into production. The original target was about 600 in 1955, but this will probably be exceeded. Premier Gheorghe Gheorghiu-Dej has stated that the 5-year plan may be completed in 4.

INCREASING STANDARDIZATION

Particular attention is being paid to the specialization of each enterprize producing machine tools and to the development of cooperation between them to secure rational utilization of equipment and increased productivity. The proper scope of each plant is being determined, together with its most appropriate range of products. Standardization in manufacture is rigidly enforced. Virtually all the Soviet production techniques are being applied, and Soviet lathes and other machine tools are almost standard

equipment in Rumanian factories. New records in metal-cutting rates are reported, and the outstanding Rumanian lathe operator, now said to be working on his 1970 production schedule, claims an average cutting speed of 1100 to 1500 fpm, using a Soviet method, compared with a normal 190 to 240 fpm.

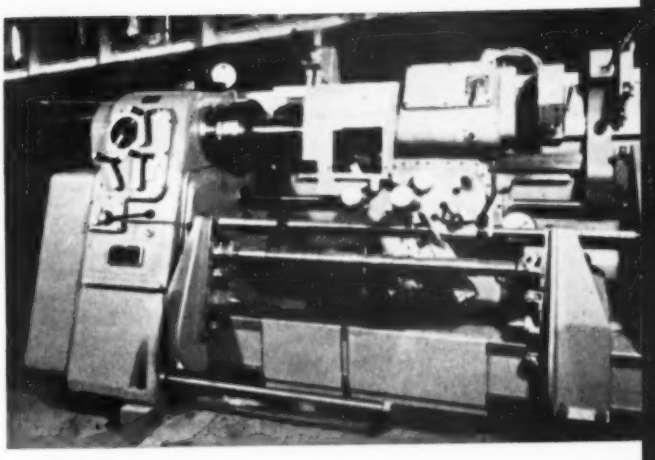
Rumania's announced intention of concentrating on small and medium machine tools during the 5-year plan is interesting in the light of some recent examples of developing economic cooperation between all the Eastern countries. Rolled metal is now being made in different profiles by the various countries, with subsequent mutual exchanges. Thus frequent adjustment of the mills is avoided and equipment is utilized to maximum capacity. It would seem that special advantages would result from application of the same principle to machine-tools.

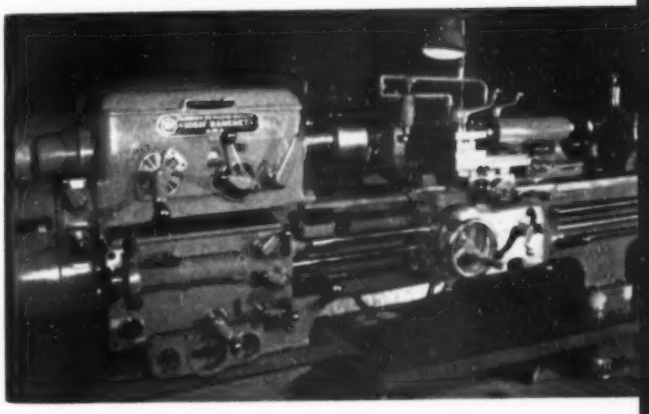
Eastern Europe would like supplies of West European machine tools and, from time to time, Rumanian spokesmen have declared their country's interest in imports from the West. At the Moscow conference, machine tools were put high in the list of goods Rumania was prepared to buy from the West as part of total possible purchases in 1953-55 valued at 1.5 million Swiss francs. Rumania is particularly interested in milling machines which she could buy from Britain, Belgium, Switzerland, France, and Germany. But restrictions aimed at preventing machines which could be used for war purposes reaching Communist countries appear to be effective, as the only machine-tool purchase Rumania made from a Western country last year was a centerless grinder from Italy.

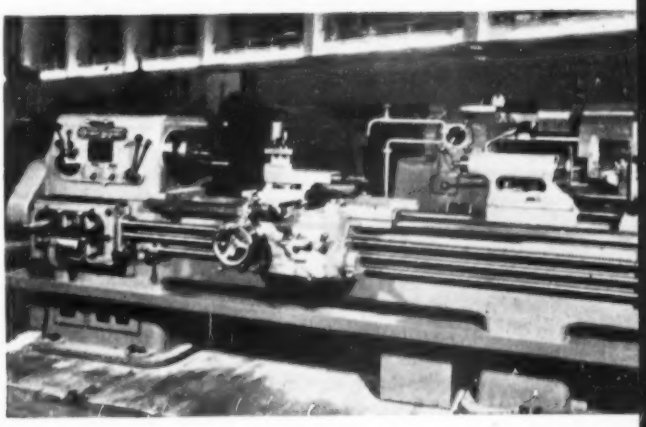
MACHINE-TOOL PRODUCTION IN EUROPE

(IN MILLION US DOLLARS AT 1948 PRICES)

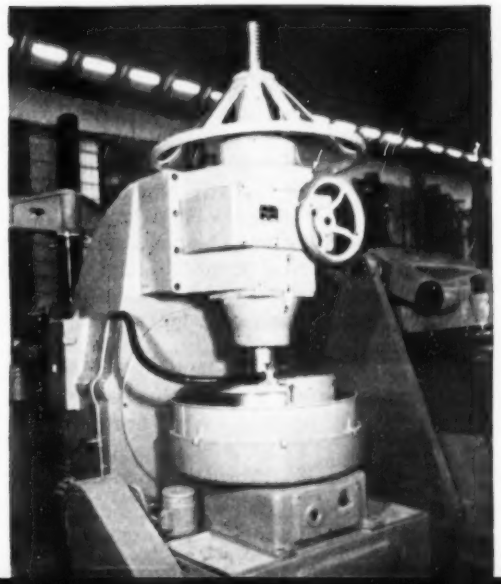
Year	All European countries	Eastern countries	Western countries
1938	607.6	27.7	579.9
1948	498.1	65.5	432.6
1949	528.1	82.6	445.5
1952/3 ... ... (planned)	733.4	146.2	587.2





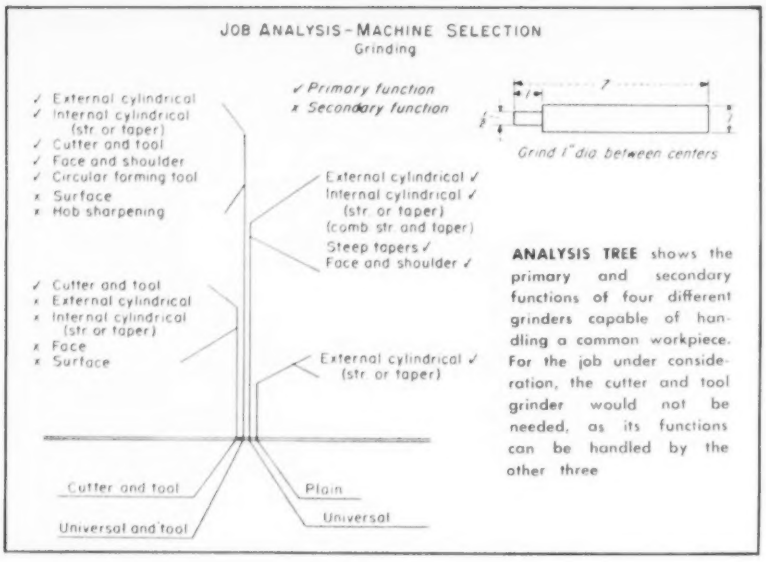


GROUP OF RUMANIAN-BUILT LATHES. Machine shown at top right is described as the prototype of a "newly developed copying lathe," but its similarity with a well known Swiss copying lathe is rather striking. The two other machines are made at Josif Ranchet plant, Arad, the first to produce lathes in quantity, for which State prizes were awarded



ROTARY SURFACE GRINDER said to have been developed specifically for ball race manufacture

How to pick the right machine tool


JOB ANALYSIS - MACHINE SELECTION
Grinding
✓ Primary function
x Secondary function
✓ External cylindrical
✓ Internal cylindrical (str. or taper)
✓ Cutter and tool
✓ Face and shoulder
✓ Circular forming tool
x Surface
x Hob sharpening
External cylindrical ✓
Internal cylindrical ✓ (str. or taper) (comb. str. and taper)
Steep tapers ✓
Face and shoulder ✓
✓ Cutter and tool
x External cylindrical
x Internal cylindrical (str. or taper)
x Face
x Surface
External cylindrical ✓ (str. or taper)
Cutter and tool
Universal and tool
Plain
Universal
Grind 1" dia. between centers
ANALYSIS TREE shows the primary and secondary functions of four different grinders capable of handling a common workpiece. For the job under consideration, the cutter and tool grinder would not be needed, as its functions can be handled by the other three

When it's a problem of increasing production, or setting up a new shop, there's always the question of which machine to buy. You can make the right selection by balancing machine functions against job requirements, as shown on the "analysis tree"

By J MEEHAN, BROWN & SHARPE MFG CO

SELECTION of the right machine tools to meet each shop and product condition is often quite difficult when more than one type of machine may be employed for a specific purpose. It is with the idea of simplifying this task that the "analysis tree" described in the following article was developed. Its basis, in fact, is the understanding that, if we determine the purpose for which a specific machine was designed, we know the purpose to which it should be applied. Obviously the rule applies to selling or selecting basic machine tools.

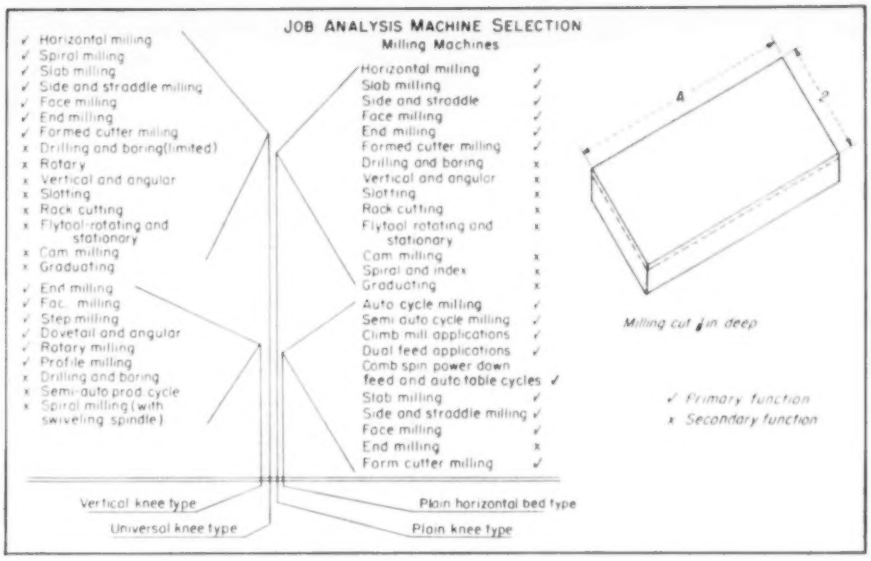
The machining operations and their sequence, the nature of the job, the results desired, and the volume to be produced; all have a definite bearing on the selection of the machine which will prove most economical. Where parts are to be made in small or limited quantities, the choice is somewhat more difficult than when mass production is involved, but the term "production" is capable of many interpretations. The common understanding involves a continuous flow of parts to and from a machine, as in an automobile factory. But a better definition might be "the machining or fabrication of similar parts at the lowest cost per finished piece passing inspection." This definition holds true whether the parts are made in lots of five or five million.

The analysis of the job will vary; so will the selection of the machine. For lots of five, the most productive elements of the machine would be: flexibility, convenience of controls, and ease of changing from one setup to another, combined with a wide range of work and cutting speeds. But if the parts are machined in such quantities as to warrant continuous running on a single operation, the productive elements are: speed, power, quick loading, automatic function to facilitate multi-machine operation, and emphasis on the reduction of the effect of the human element. This may necessitate a completely special machine or a standard machine arranged to perform a single operation or series of operations.

Before proceeding with the analysis, however, it is important to appreciate the relationship between the machine designer, the sales engineer, and the user of the machine. These three form a partnership in the ultimate objective—economical production. The sales engineer acts as liaison man between designer and customer, and can best explain the main purpose for which machine was originally designed. If the customer understands this, he can more readily appreciate for what purpose it should be used. Every machine has one or more chief purposes — its other functions are ancillary and are intended to broaden the field of application.

For example, the primary purpose of a drillpress is the drilling of holes. It can also be used for tapping, with or without a special tapping attachment. If the present bottleneck is the tapping operation, it would be poor economy to purchase another drillpress and tapping attachment. The logical move would be to buy a standard tapping machine.

If you plan to buy a boat for sailing on bright summer days, you need just a sailboat—you can get



FUNCTIONS OF FOUR MILLING MACHINES are set out on this tree. Selection of the model or models best suited for the job will be governed by the quantity of work and the particular operations to be performed

along without an auxiliary engine. But if you plan to go sailing almost every day, regardless of the wind, then the engine is essential. On the other hand, if you are going to operate a ferry service in fair weather or foul, then it would be better to forget about the sails and buy a power boat.

It is of the utmost importance, therefore, when considering the purchase of new equipment, to furnish the manufacturer with every possible piece of information as to the job to be done. Lack of such data hampers the sales engineer and prevents him from presenting the most economical proposals. If the problem is a new project, past performance and experience are, of course, limited; but if it is a job on which the objective is to increase production, you should give the builder the benefit of your past experience, and complete data on the characteristics of the job. This will give him a starting point. Tell him how you are doing it now and what difficulties you encountered. The more information you give him, the less research he will have to do and the more efficient will be the proposition he is able to present. If you have found that some unconventional method has proved successful and economical on the old machine, it may be possible for the designer to incorporate those special features into the machine on which he is quoting. But he cannot do this unless you tell him about it.

MAKING THE ANALYSIS

Consider the case of a jobbing shop or small-lot department in which productive capacity must be increased or an obsolete machine replaced. Usually, in such shops, turning, milling, grinding or drilling machines must cover a broad range of different operations, so the first step is to determine in which phase of the operations it is necessary to increase capacity. For example, assuming additional grinding capacity is needed, you must decide whether the new machine shall be a plain grinder, a universal grinder, a cutter and tool or universal and tool grinder, or a surface grinder. That is the main problem, as you may have use for all four types.

Suppose you need an additional 100 hours of grinding per week, divided into: external cylindrical 60 hr, internal cylindrical 25 hr, tool and cutter grinding 10 hr, and surface grinding 5 hr. Operating 40 hr per week, it is evident that you will need three machines, and that economy with flexibility is of the highest importance. Thus the question arises: what three types of machines can give you the maximum efficiency and flexibility of application.

The first step is to construct an "analysis tree," as shown in the accompanying illustrations. Some common denominator must be selected—in this case, assume a workpiece 1 in. in dia, 12 in. long, and select four machines large enough to grind this cylindrical work straight or with a moderate taper with either standard equipment or standard attachments. Set down the names of the four types of machines available and then, by analyzing and noting their primary and secondary functions, you will more readily and simply solve the problem of selection. The decision as to which machines to set down will be governed, naturally, by the type of work to be done. There would be no point in setting down a surface grinder for the 5 hr required, as other machines can handle this operation.

Indicate the primary functions of each machine by a check mark, the secondary by an asterisk. These are the types of operations for which the machines were designed and are best suited: They are the classes of work to which they should be applied.

In general, the machines with the greatest number of check marks are the ones to select, but there are some controlling factors to be considered. To do the 100 hr of grinding in the most economical manner, it is evident that you should have one plain grinder. Regardless of the number of parts in a lot, the

plain grinder will do a plain grinding job in the most economical manner. With 25 hr of internal grinding time, a universal machine can handle this and have time to take care of 15 hr of the missing 20 hr of external work. A tool and cutter grinder, fitted with an internal grinding attachment, can, however, take over some of the internal work and permit the universal machine to take over the full 20 hr of extra external work. If a universal and tool grinder is applied, rather than a tool and cutter grinder, it can assist with the cylindrical external and internal, and will be adequate to take care of the 5 hr per week of surface work. Thus, three machines will handle all the work in the most economical manner, and the flexibility will provide a flexible schedule for any additional miscellaneous grinding to be performed.

This method of analysis can be applied to various other machine groups where several different types of machines of similar characteristics—as engine lathe, turret lathe, hand screw machine, and automatic screw machine—pose a similar problem. It is in such cases that both sales engineers and production engineers so often err, either through lack of careful analysis, or through fanaticism—for which there is no suggested cure.

PRODUCTION JOBS

For long-run production setups, you have a different set of conditions to consider. If the machine will operate continuously on a single operation, the choice lies between one designed specially for the job—which may be a modified standard machine—and a standard machine with special arrangements to suit the application; whichever gives the highest production at the lowest cost. An entirely special machine, operating automatically, is generally quite expensive, and sufficient volume of work to cover the expense must be assured before you embark on such a project.

If the volume does not warrant a special machine, and a standard machine with special devices seems the proper selection, make sure that the special equipment is readily removable to leave a standard unit available for other work. For economic reasons, standard machines or basic standard units should be applied as far as possible.

Recent improvements in standard machines have raised their productivity far beyond what was possible only a few years ago. For example, bed-type milling machines, through convenience of adjustment for setup and simplicity of operation with full or semi-automatic cycles, have proved applicable to extremely small lot production. Automatic feed and rapid travel to the spindle head, which may be combined with table movement yet may instantly be made inoperative to leave a regular standard machine, is available on some plain milling machines. Similarly, automatic grinding cycles with adjustable spark time put short or moderate lots on a high-production basis, and automatic cycle and sizing arrangements, whereby the automatic cycle is terminated by the work diameter for longer runs to close tolerances, are available on both universal and plain grinding machines. These automatic cycles may be made inoperative in an instant, leaving again a standard machine for short runs of dissimilar parts. Thus, automatic machine cycles for application of mass-production methods are now available for, yet not confined to, mass-production elements. In many cases, these automatic cycles enable operators to take care of more than one machine. In other cases, less-skilled operators may be employed, thus reducing the cost of production.

Because a job is a toolroom or job-shop application does not mean that all machines should be universal; this is a common error made by both large and small manufacturers. Generally speaking, the more universal the machine, the less rigid it is. Therefore, when you apply a universal machine to plain work exclusively you are sacrificing production for versatility, and you cannot have full benefit of both. Careful analysis, therefore, will lead you in the right direction. Nevertheless, if you now have a particular machine for performing a certain operation without change or with slight modification, use it if you have sufficient work to warrant it. Frequently, makers of cylindrical grinding machines are called upon to arrange a machine specially for cam grinding. If the quantity is small or only a minor part of the time is to be consumed for such work, and no standard attachment is made, it might be profitable to make a special attachment. But if there is enough work of this kind to be done, there are several excellent cam grinders on the market which can be applied to the job by merely making a special former to suit.

Look around your own shop. How many vertical milling attachments have you? And how many are in daily use? How many universal milling machines spend 90% of their time on plain work? It's your own money you are wasting if you don't buy the machine that will give you maximum output at minimum cost.

"Anyone know how to stop a toilet from running?"

ROUND TABLE

Indian Giver

"I hear you got put on the carpet this morning, Ed. What's the boss so het up about?"

"Bad news sure travels fast around here, doesn't it? Well, I guess it is bad news for Tom Jones and Dick Hartley. I promised awhile ago to let them off for a week at the start of the hunting season, but the boss has just put thumbs down on the deal. It seems the personnel department has to give written permission now for any unusual vacation time."

"I thought you had that all worked out with the boys, Ed. Weren't they going to give up a week of the regular vacation time to make up for the hunting trip?"

"That was the idea, Al. It still won't do, but that isn't what makes me really mad. Here I've worked out a thing to help some of my men, and the boss second-guesses me. He makes a liar out of me, and at the same time he takes away some of my authority as a foreman."

"Well, Ed; it really isn't as bad as that. Actually he's relieving you of a lot of trouble. Seems to me we have most of our worry just from personnel relations of one sort or other. It's tough on Jones and Hartley in this case, but the idea isn't bad."

"I think it is a bad idea, Al. They heap a lot of dirty jobs on us as foremen, but now they take away one of the easy ones. I can't think of any better way to keep the men on my side than to help work out special vacations and time off, as long as it doesn't interfere with the work."

"True enough, but maybe it's better if the front office decides when the work load will allow special treatment. After all, they have a better idea of how the work load will fall, and they can tell better when's a good time to allow special privileges."

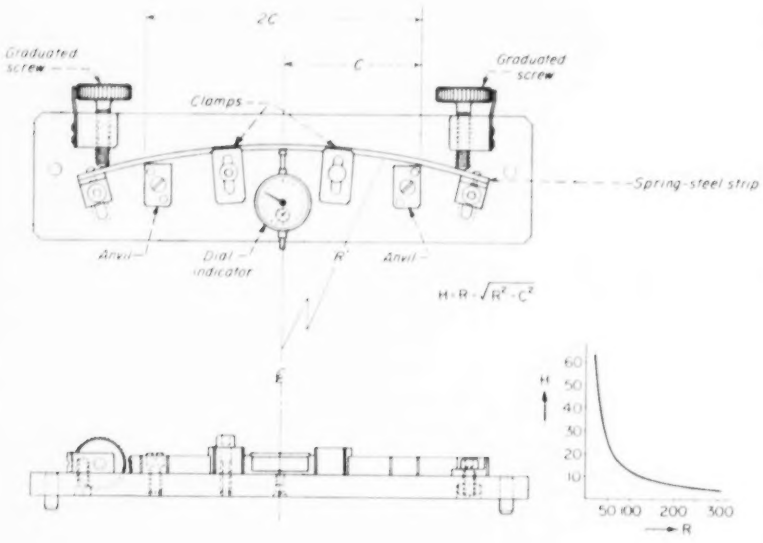
"Look, Al: I can tell better than anyone up in that glass office when I can afford to be slightly short-handed. That's one of my jobs as a foreman. And I'm getting damned sick and tired of all this interference and red tape!"

"Take it easy, Ed. I still think if you weren't so resentful, you'd realize that anything the office can do to help you out is to the good. It simplifies everything if the company has a policy on this kind of thing—then you have an easy out if you can't make a deal because of the work load."

"I don't want an easy out on this thing, Al. It's part of my job to decide who can get off when, and I don't like the boss taking back something that belongs to me."

***DOES** increased regimentation help or hinder the foreman? Is Ed too resentful of the front-office authority, or is Al wrong in suggesting that this is a foreman aid, not a slap in the face? Your opinions may help others with similar problems. Discussions of earlier topics appear on later pages.*

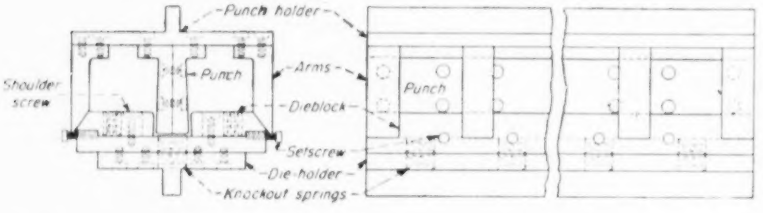
Practical Ideas



Producing Radii for Optical Tools

Producing large radii for templets and cams necessary for various copying and gaging purposes in optical manufacturing, is often a slow and awkward procedure. However it can readily be accomplished by using the fixture shown. The basic principle consists of placing a strip of spring steel, of uniform and maximum thickness to insure functioning and proper rigidity, between two matched and graduated screws which impinge against the strip.

When these screws are adjusted deflection occurs between the anvils which are screwed and dowelled to the baseplate. The important dimension of the deflection is measured by a firmly attached dial gage. Two or more clamps are used to retain the contour attained, care being taken not to warp it when applying the clamps. The graph will speed setting up when the tolerances are excessive otherwise the basic formula is $H = R - \sqrt{R^2 C^2}$. *Herbert H. Fromicke, Somerset, England*



Adjustable Die for Channelling

By constructing the punch of two sections bolted together, and capable of being separated for various width insertions and by the use of a flexible arrangement of the die-block, we were able to use the same press and fixture for U-channelling steel to any desired width within constricted limits.

Dimensions of this fixture, of course, are according to individual requirements but the toolmaker should pay special attention to construction of the female unit.

It consists of two strips, one placed at each side of the opening, with each strip separated from the other by a compression spring and each utilizing several shoulder screws and slots.

To gain the side pressure necessary to close the female die-strips, a series of arms, attached to each side of the punch block, descend with it, supplying the side pressure with a bevel camming action, and bringing the die units together laterally forming the sides of the orifice.

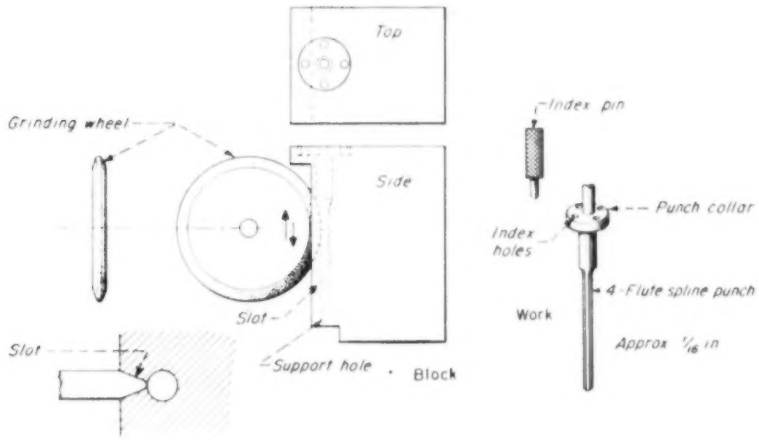
Upon raising the punch and releasing the cam action the two strips separate, allowing for the extraction of the work which is pushed up by knockout springs inserted in the base of the die under the work.

As the punch unit rises, the reaction of the female side strips must be controlled. To do this, several screws are inserted on the side of the die bed. *T H Hsu, Formosa, China*

Ed Note: Our contributor makes no mention of what happens to the punch-holding plate when the punch-holding screws are moved for inserting of the spreading plates. We assume that slots are used.

Filter With Grinding Wheel

An old grinding wheel makes an excellent filter for cutting fluids, acids, alkalis, and many other liquids. The wide range in grain size and porosity provides a filtering medium for almost any condition. Installed in the line of a standard coolant system, a grinding wheel provides a large volume of well filtered coolant. *Charles Gray, Tolleson, Arizona*

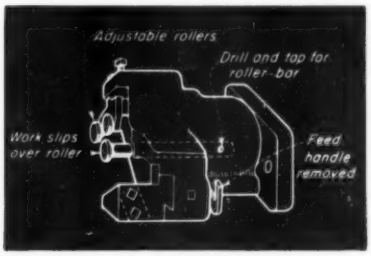


Grinding Small Spline Punches

In watchmaking the machinist is sometimes confronted with the difficult task of grinding spline punches which are too small to be chucked or suspended between centers. The illustration shows a grinding block especially drilled to hold this kind of work.

The interesting idea in this tool is that a grinding-wheel, dressed to a specified radius, (in the instance shown 0.0068 in.), is allowed to cut a slot into the front of the block in line with the drilled hole, until just after breaking through. Stopping at this point allows a small amount of metal to remain at points X and X X, which, in subsequent production grinding, when the slot serves as a grinding channel, prevent the punches from climbing into the wheel.

At the top of the block, four index holes serve to position the splines or flutes of the punches with the grinding-wheel by means of an index pin operating through matching holes in the collar of each punch unit. *David Worth, Dayton, Ohio*



Tool Rolls Brass Tubing

I was asked to evolve a method that would salvage some short lengths of hard-to-get brass tubing that was indented and out of round.

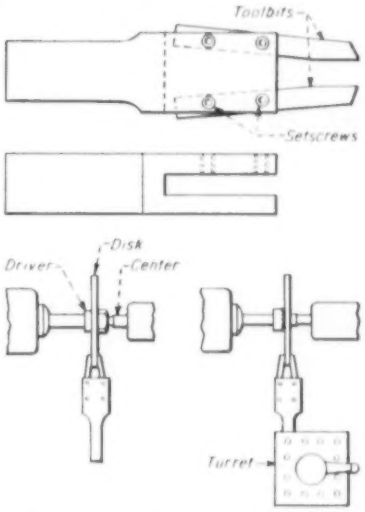
After some thought I fitted a core-bar to a roller turning-tool. Then I tapped the end of this bar to hold a roller slightly smaller than the inside diameter of the tubing. Next, I drilled and tapped the turner to hold the bar. There was nothing more to do other than to adjust the rollers of the turner firmly on the outside diameter of the tubing.

Thus the turner rollers ran directly over the inside roller on the bar and re-rolled the tubing eliminating dents and restoring the round to 0.001 in. As the tubing was later to be cut into 2-in. lengths, the arrangement worked out very nicely. *Sylvester Brogle, Cleves, Ohio*

Dual Turning Tool for Machining Washers

When machined washers are needed, they are first cut from bar stock. Following cutting, the center holes are drilled. Then the washers must be machined parallel. This operation is usually difficult because of the danger of warping. In our shop we devised a tool which machines both sides of the washer simultaneously.

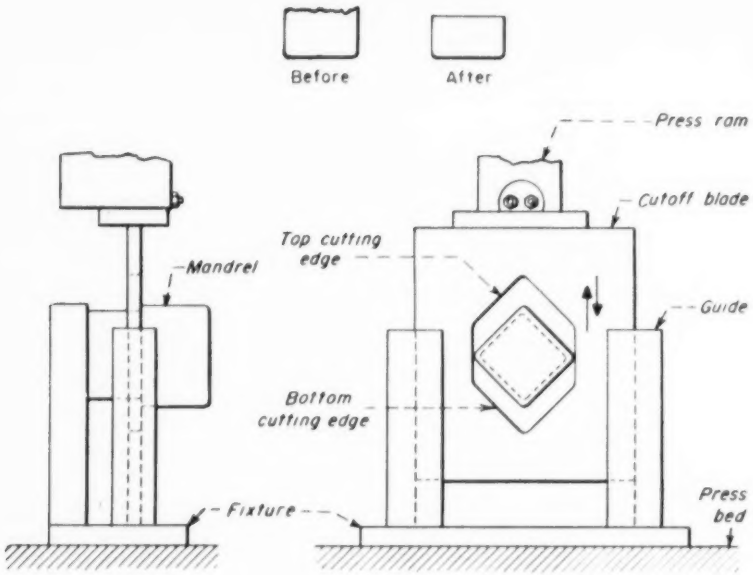
The washer is placed on a mandrel mounted between centers. A special tool, designed to do the turning, was fitted with two opposing tool-bits, properly spaced and sharpened, and held by the toolpost on the cross-slide. These toolbits are ground for left and right cutting and are positioned for clearance. As both sides of the washer are simultaneously cut, possible distortion is reduced.



Disks of material other than steel may also be turned with this tool, but of course, having no center holes, the drive must be friction and the center area will require subsequent attention. *Edward Diskavich, Torrington, Conn.*

Rotary Brazing Setup

Having several hundred tubes to accurately assemble to a short collar insert and a budget that wouldn't permit induction heating equipment, we set up a surplus speed reducer motor (286 rpm) to rotate a vertical positioning mandrel and mounted a needle-flame gas burner. The job was neat and fast. *R J McKenzie, Minneapolis, Minn.*



Flash Trimming Speeded Up

On a long production run on drawn aluminum boxes, we were trimming the flash in the usual way. The box was slipped on a mandrel and the two upper edges were trimmed with a V-shape blade. The box was removed, rotated 90°, and replaced for the second cut.

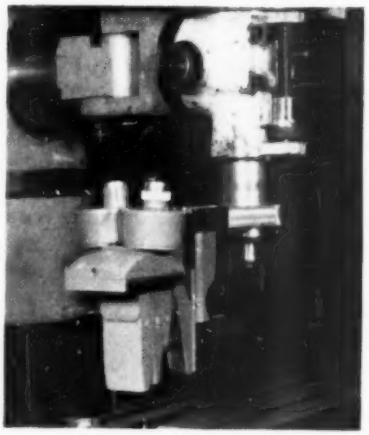
It was important to speed up the process so we checked our presses and found that certain makes could easily be altered by slipping off the clutch sleeve, rotating it 90°, and replacing it. The result of this change was to have the stroke end with the crankshaft in the 90° position (ram half-way down).

Then we constructed a die fixture as shown in which the ram descends and trims the two upper sides of the box. As the shaft rotates further the ram rises to the top of the stroke and the blade trims the two lower sides of the box. The vertical distance from the mandrel to the upper or lower cutting edge is equal to one-half the stroke, less the overlap of the cutting edges and less the allowance for grinding when dull. By eliminating the need to remove and turn the product we increased production 75%. *Clifford Molloy, Bronx, N Y*

Toolmaker's Microscope Measures Irregular Surface

We had a lot of parts which had to be measured to tolerances withing 0.001 in. As the parts measured 5 in. by 10 in. and had a series of raised projections and machined depressions, close together, we could not use calipers or height gages. Part size prevented our using the toolmaker's microscope for direct measurement. I mounted a laboratory microscope on the head of a Bridgeport miller and built a special fixture. Then we used the graduated dials on the crossfeed screws of the miller and a single reticle in the microscope.

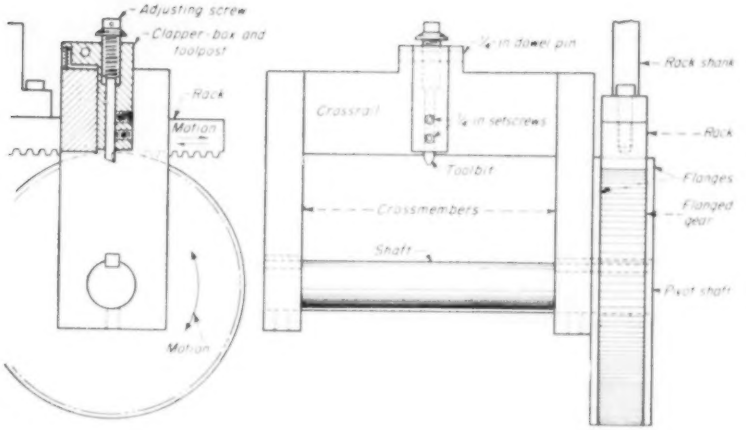
This setup can be adapted to any miller. Care must be taken that no power is on and that the microscope is clamped to the quill. A 60-power 'scope is ample. *Paul V Jones, Oreland, Pa.*



How to Lay Out A True Ellipse

There are a number of ways to lay out an approximate ellipse and a few ways to describe a perfect one. Most methods are complicated or require a lot of time. Here is a method that is quick, simple, and foolproof. All you need for equipment is a beam trammel with two pivot points, instead of one point, and a plate having a pair of grooves cut into it at right angles to each other, to guide the trammel points.

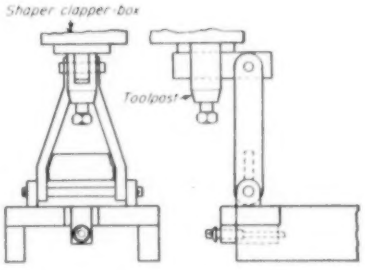
Set the plate on the work where the ellipse is to be drawn, with the center of the crossed grooves at the ellipse center. Call the outer pivot "A," the inner pivot "B," and the marker "C." To set the trammel, AC should equal one-half of the ellipse' *major* axis and BC should equal one-half of the *minor* axis. The grooves are labeled a-a and b-b. Keep pivot A in its groove a-a and pivot B in its groove b-b at all times. Now all you have to do is swing the marker "C" as though you were describing a circle and allow the two pivots to slide in their respective grooves as is their natural tendency. Just be certain that neither of the pivots leaves its groove at any time. You will find that it is as easy to draw a perfect ellipse as it is to swing a circle. For some jobs, or ellipses, you will find that it is more practical to substitute try-squares or straightedges for the grooved plate. *S F Delano, Rockland, Maine*



Shaper Used for Machining Radii of Knuckle Joint

In shops lacking milling, broaching, or splining machines, or when production does not warrant acquiring expensive special cutting equipment, a simple attachment will enable a shaper to cut the radii of a knuckle joint providing the joint has a center hole to act as a pivot. The attachment, which uses the knee to hold and feed the work, consists of a flanged gear operated by a rack and shank from the clapper-box toolpost. Two cross members are attached to the pivot shaft and support a cross-rail. This cross-rail is supplied with a toolbit complete with adjustments and springs.

To increase the range of the cut longitudinally as well as radially,



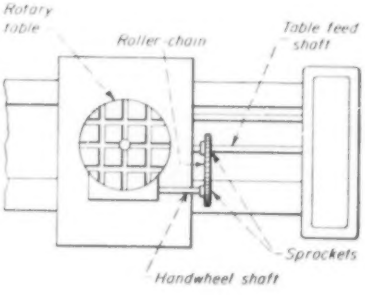
the flange gear and the rack are replaced by a linkage arrangement at the clapper-box toolpost (Fig. 2)

Of course this attachment is limited in scope and a new fixture must be designed if its limits are exceeded. *Richard Putnoky, Roselle, N J*

Automatic Drive for Boring-Mill Table

We discovered that a motorized table for a horizontal boring-mill was comparatively expensive. Yet our requirements called for an arrangement less time consuming than manual operation.

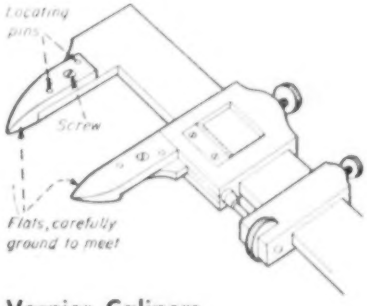
By attaching a sprocket to the feed shaft and replacing the handwheel with a sprocket of the proper ratio for the job and connecting the two with a chain, an entirely satisfactory automatic drive was



achieved. *Robert B Holder, Troy Hills, N J*

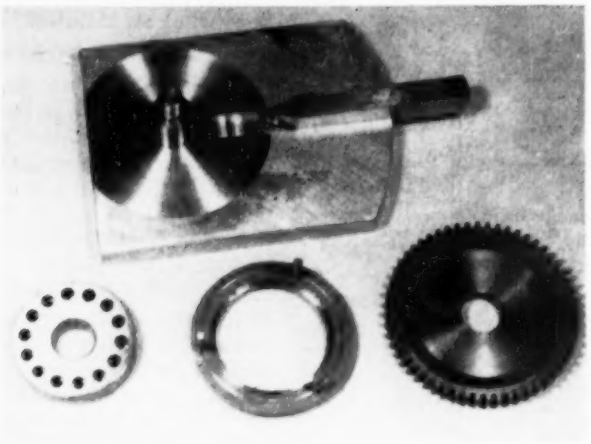
Soldering Aluminum With Ordinary Equipment

We recently had the problem of soldering some assemblies of aluminum sheet and discovered that a considerably higher temperature is needed than will join other materials. This temperature demand makes the usual style of soldering iron unsuitable and we found that direct heating with a blowtorch, or gas-air torch, is the usual method. A better technique is to preheat the aluminum to about 250 C and then sprinkle some ordinary fine filings of tinsmith's solder onto the aluminum surface. This solder should be melted by local heat from an electric soldering iron. The solder will *not* unite with the aluminum surface because of the oxide film. However, if a brass wire scratchbrush is mounted in a portable electric drill and the solder-wet surface is brushed, the solder can be scratched in and the whole surface quickly tinned. As the brush removes the oxide, the solder slips in and grips the raw metal. We have tried many different methods and none of them were as simple and satisfactory as this one. If the scratchbrush could be attached to a portable vibrating sander, the result should be similar. *W E Warner, Woodford Green, Essex, England*



Vernier Calipers Used as Scriber

By attaching two carefully fashioned, hardened steel points to the lips of a vernier caliper it may be used as a scriber of two parallel lines or as a compass to locate accurate distance. The two points should produce the vernier reading. *T H Hsu, Formosa, China*



Accurate Hole Location With Spur Gear Tool

Here is a simple method which works very well for accurately boring holes located on the radius of a circle. The drill jig shown is an excellent example of the work that can be accomplished with this setup.

A toolmaker's button is placed on the drill jig, at the required distance from the center of the jig, to locate the first hole. Now the gear and the jig are assembled to the stub shaft of the adapter plate. (A close fit is necessary.) The gear is clamped to the jig with a ring clamp as shown. The assembly is attached to the faceplate on a lathe and, after careful alignment, one tooth of the spur gear is picked up with the index bar. Then the stub shaft nut, that holds the gear, jig, and clamp assembly to the adapter, is tightened.

Next, the toolmaker's button is indicated until it is exactly zeroed and the adapter is clamped to the lathe faceplate. After clamping the adapter, the toolmaker's button is removed, the index bar is taken away, and the first hole is bored. To index for the next hole, the shaft nut is loosened and the assembly is rotated until the proper tooth is picked up by the close fitting index bar. Then the work is reclamped and the hole is bored as before.

The pitch of the gear is determined by the number of holes required in the jig to be drilled. The setup shown uses a 56-tooth gear to index a 14-hole jig. Marking the proper teeth on the gear, for indexing, will minimize indexing errors and the use of generated-tooth spur gears will increase indexing accuracy. When high speed cutting is used, the faceplate should be counterbalanced to reduce vibration. With this setup, properly planned, we have accomplished work that would be difficult to improve upon with a first-class jig-borer. A rack of suitable gears can be kept handy and exclusive for indexing. *W C Magee, Schenectady, New York*

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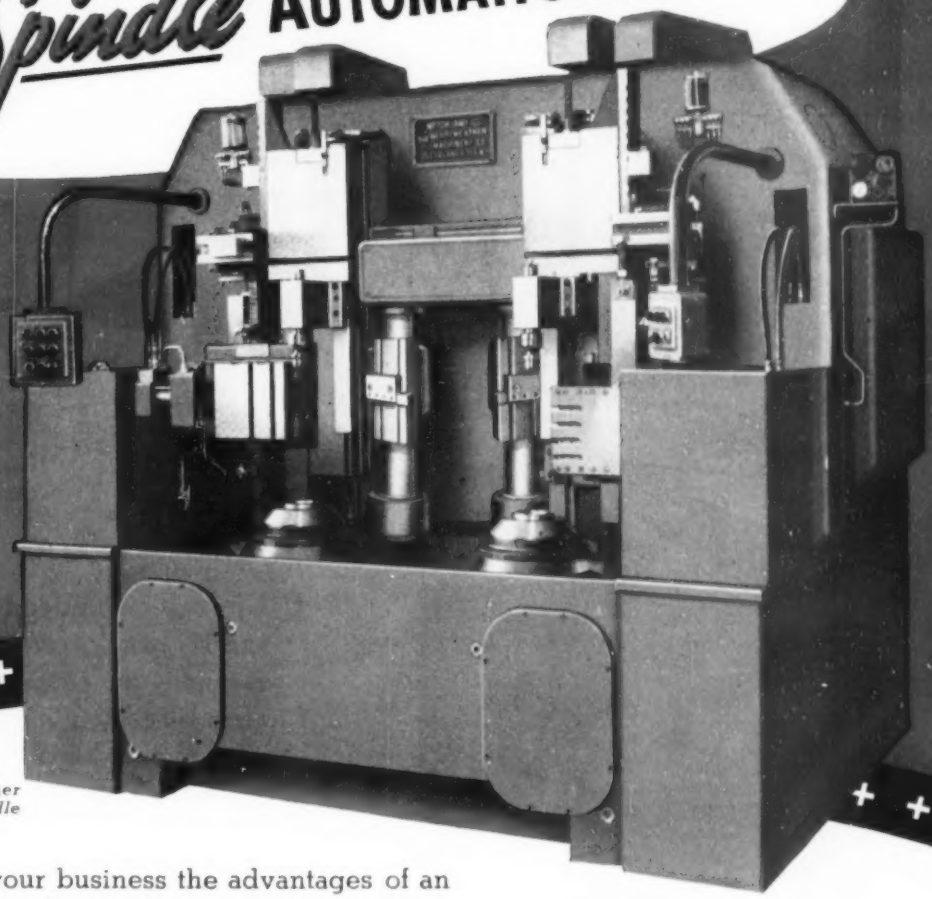

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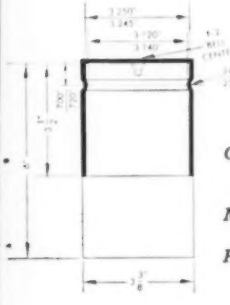
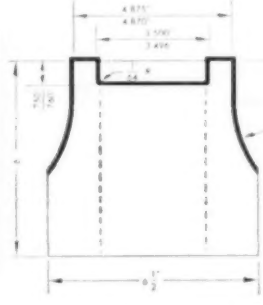


Case Study No. 96

Operation – Turn, face, groove and center drill.
Material – SAE 1335 annealed.
Production – 124 pieces per hour.



Case Study No. 124

Operation – Turn, face and bore.
Material – Gray iron casting.
Production – 60 pieces per hour.

STANDARD SPECIFICATIONS

Chuck diameter	10"
Swing	12" dia.
Work height: chucking	12"
between centers	16"
Turning slide, vertical feed	14"
Boring slide, vertical feed	14"
Facing slide, horizontal swing	6"

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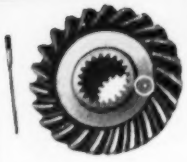
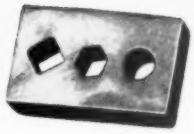
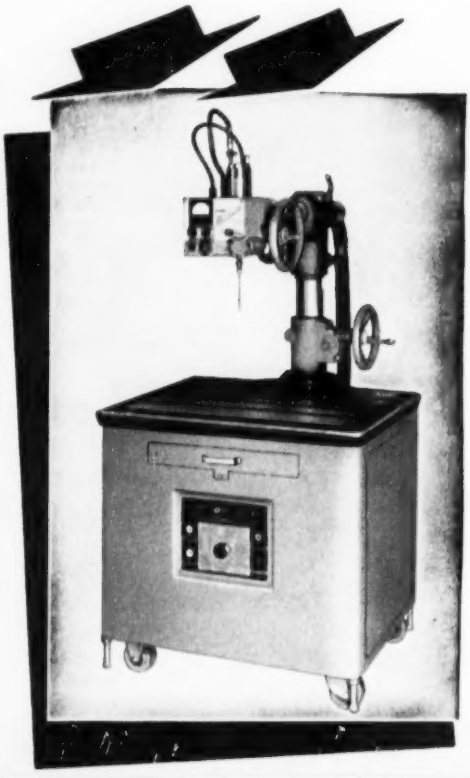


Cut oil holes in hardened gears without annealing

Cut dovetails in hardened dies



Cut any shape hole in cemented carbides



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BY V. G. HOTCHKISS, Industrial Engineer, DEERE & CO.

HANDLING WITH BODY TRAVEL

Simple means are required for estimating handling times for castings, forgings and parts of a chunky nature. Either of two conditions may apply: (1) the worker must move his body, or (2) he need only reach, grasp and move the object but no movement of the body is required. Data for situations requiring body travel are given on this page and in Table I, and other data for situations not requiring body travel are given on page 189 and in Table II.

See also the normal minutes for loading and unloading typical jigs and fixtures, page 191.

In developing the normal minutes for handling, *where the body travels*, no allowance was included for fatigue, personal needs or job delays. Conditions where the body travels are:

(A) Body travel precedes obtaining the casting but does not follow obtaining of the casting. Note: *Move* and release follows the obtaining.

(B) Body travel and release follows the obtaining of the casting but does not precede the obtaining of the casting. Note: *Reach* precedes the obtaining.

(C) Body travel precedes the obtaining of the casting and body travel and release follows the obtaining of the casting.

The normal minutes to perform the above work can be determined for any weight casting that one man is capable of handling, and any distance reached to the casting, and any distance the casting is moved. Normally, the maximum reach or move is about 30 in., and any distance walked (empty) to the casting or walked (loaded) with the casting. The requirement is the *body does travel.*

Abreviations are used to show how the body has traveled, such as "W to W travel" means that the hands are above the knees and below the shoulders or at *waist* level when starting to travel and when completing the travel the hands are still at *waist* level.

"W to F travel" means the hands are at the *waist* level when starting to travel and when completing the travel the hands are below the knees or at *floor* level.

"F to W travel" is the reverse of the above.

"F to F travel" means the hands are at the *floor* level when starting to travel and when completing the travel the hands are at the *floor* level.

If preceded and followed by body travel "W to F to W travel" means the hands are at the *waist* level when starting to travel (empty); and when completing the travel, just before obtaining the part, the hands are at the *floor* level. After obtaining the part the hands are at the *floor* level at the start of the body travel, and after completing the body travel with the part, the hands are at *waist* level.

The start and destination for body travel must be known to obtain the proper constant which is added for the particular case. In the above "W to F to W travel" the constant is 0.044 min.

These formulas will be useful in determining the time required (when the body travels) for handling material to and from lathes, mills, drills, and other machine tools, and for assembly work. They do not include the subsequent positioning, etc. required after the part has been transported to its jig or fixture. Likewise, it does not include disengagement of the work from its jig or fixture.

Complete tables can be developed to cover the entire range of weights in your plant, assuming you know the distances and the travel locations (outlined above) on the jobs.

TABLE I—CONSTANTS FOR HANDLING WHEN BODY TRAVELS

(A) Body travel precedes but does not follow move†:

Preceded by	Constants
W to W travel	0.013 (a)
W to F travel	0.020
F to W travel	0.020 (b)
F to F travel	0.038 (c)

For walking (empty) to part, grasping, moving, and releasing part.

(B) Body travel follows but does not precede move*:

Followed by	Constants
W to W travel	0.024 (d)
W to F travel	0.031 (e)
F to W travel	0.031
F to F travel	0.049 (f)

For reaching to part, grasping, walking (loaded) with part and releasing part.

(C) Body travel precedes and body travel follows move†*:

Preceded and Followed by	Constants
W to W to W travel	0.030 (g)
W to W to F travel	0.037
F to W to W travel	0.037
W to F to W travel	0.044
F to W to F travel	0.044 (h)
W to F to F travel	0.062
F to F to W travel	0.062
F to F to F travel	0.080 (i)

For walking (empty) to part, grasping, walking (loaded) with part and releasing part.

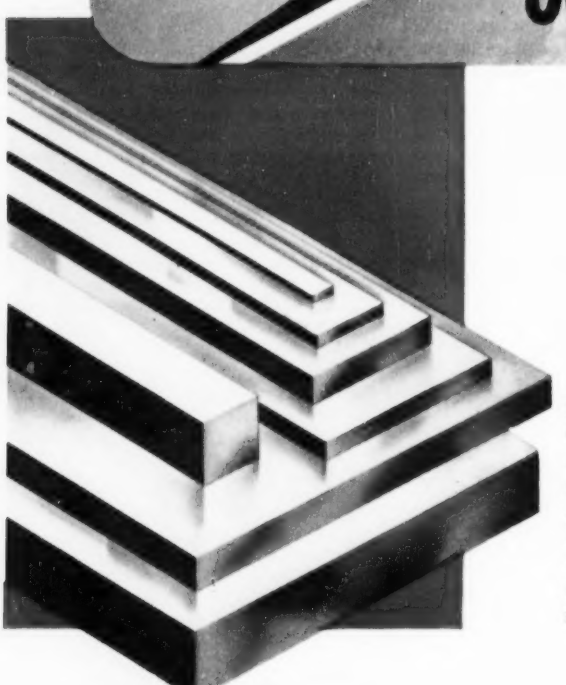
VARIABLES			USE FOR MOVE:		*ADD FOR WALKING WITH WEIGHT			
Weight	0.0004	per lb	Max Wt.	Per In.	CARRIED	W to W	W to F	F to F
Reach	0.0004	per in.	20 lb.	0.00053	10	0	0	0
Walked	0.0044	per ft	30 lb.	0.00056	15	0.001	0.003	0.003
			50 lb.	0.00059	20	0.004	0.008	0.008
			70 lb.	0.00062	25	0.007	0.013	0.013
			90 lb.	0.00065	30 & up	0.010	0.021	0.021

*Add for walking empty when procuring weights over 10 lb—constant = 0.0018.

GENERAL NOTES:

(1) Walking at 0.0044 per ft is based on a 24-in. step and is considered to be done under shop conditions where there are various obstructions such as machines, tote boxes, etc. (2) Walking in the "open" where there are no obstructions would have a value of 0.0035 per ft.

(3) The distance walked is the overall distance covered from the place the leading foot makes its first step to the place the leading foot (or both feet) completes the travel.*



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FLAT GROUND
DIE STEEL

The Ready-to-Use Steel of 1001 Uses!

Simonds offers you a choice of OIL or AIR Hardening DIE STEEL, whichever is best suited to your requirements. Both types are made from Simonds own steel, are precision ground to a thickness limit of plus or minus .001" and have an extra smooth surface finish of 25 to 35 micro inches. Edges and ends are square and parallel, with all scale, decarburation and surface defects removed. All sizes come individually packaged with heat treating instructions.

SIMONDS AIR HARDENING DIE STEEL

(non-deforming 5% Chrome Type) is spherodize annealed for good machinability and uniform hardenability. Its wide hardening range (1700° to 1800° F.) makes it practically foolproof in heat-treating. Stock sizes run from $\frac{1}{2}$" to 2" thick and 2" to 10" wide in 36" lengths.

SIMONDS OIL HARDENING DIE STEEL

(non-deforming Molybdenum Type) is uniformly annealed for easy machining and uniform hardening. Due to its wide hardening range (1450° to 1540°) good results are assured with even the simplest heat treating equipment. Stock sizes are available from $\frac{1}{64}$" to 3" thick and $\frac{1}{8}$" to 14" wide in 18" lengths. The heavier sizes also come in 36" lengths.

SIMONDS SAW AND STEEL CO.

FITCHBURG, MASS.

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon
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Handling Times...II

EXAMPLES FOR CONDITION A
W to W travel

Constant (a)	0.013
Walk 6 ft	0.026
Weight, 20 lb.	0.008
Walk empty	0.010
Move 30 in.	0.016
Min.	0.073

F to W travel

Constant (b)	0.020
Walk 3 ft	0.013
Weight 80 lb.	0.032
Move 10 in.	0.007
Walk empty	0.010
Min.	0.082

F to F travel

Walk 5 ft	0.022
Weight 10 lb.	0.004
Move 20 in.	0.011
Constant (c)	0.038
Min.	0.075

EXAMPLES FOR CONDITION B
W to W travel

Constant (d)	0.024
Reach 30 in.	0.012
Weight 1 lb.	0.001
Walk 6 ft	0.026
Walk loaded	
Min.	0.063

W to F travel

Constant (e)	0.031
Reach 10 in.	0.004
Weight 50 lb	0.020
Walk 3 ft	0.013
Walk loaded	0.021
Min.	0.089

F to F travel

Constant (f)	0.049
Reach 20 in.	0.008
Weight 30 lb.	0.012
Walk 6 ft	0.026
Walk loaded	0.021
Min.	0.116

EXAMPLES FOR CONDITION C
W to W to W travel

Constant (g)	0.030
Walk 6 ft	0.026
Carry over 10 lb.	0.010
Weight 20 lb	0.008
Walk 6 ft	0.026
Walk loaded	0.004
Min.	0.104

F to W to F travel

Constant (h)	0.044
Walk 3 ft	0.013
Weght 5 lb	0.002
Walk loaded 3 ft	0.013
Min.	0.072

F to F to F travel

Constant (i)	0.080
Walk 6 ft	0.026
Carry over 10 lb	0.010
Weight 40 lb	0.016
Walk 4 ft	0.018
Walk loaded	0.021
Min.	0.171

HANDLING WITHOUT BODY TRAVEL

Table II gives the normal minutes for handling castings, forgings, and other parts that are of a compact and chunky nature, similar to castings. These data are for use in situations only where the body *does not travel*, but remains stationary. No allowance is included for fatigue, personal needs or job delays.

The data cover normal minutes for reaching to, grasping, moving, and releasing the piece. Normal minutes can be determined to perform the above work for any weight of casting that one man is capable of handling, for any distance reached to the casting, and any distance the casting is moved. Normally, the maximum reach or move is about 30 inches.

This formula will be useful in determining the time required (when the body does not travel) for handling material to and from lathes, milling machines, drilling machines and other machine tools, likewise for assembly work. It does not include the subsequent positioning time, required after the part has been moved to its jig or fixture. Likewise, it does not include the time for disengagement of the work from its jig or fixture.

With the basic data provided, you can develop tables of handling times for the entire range of weights in your plant, assuming you know the distances the pieces are moved.

TABLE II—NORMAL MINUTES WITHOUT BODY TRAVEL

(For reaching to, grasping, moving and releasing the part)

Constant	0.011
Variables:	
Weight	0.0004 per lb
Reach	0.0004 per in.

Move	Wt Max	Per In.
	20	0.00053
	30	0.00056
	50	0.00059
	70	0.00062
	90	0.00065

EXAMPLES:

NO. 1

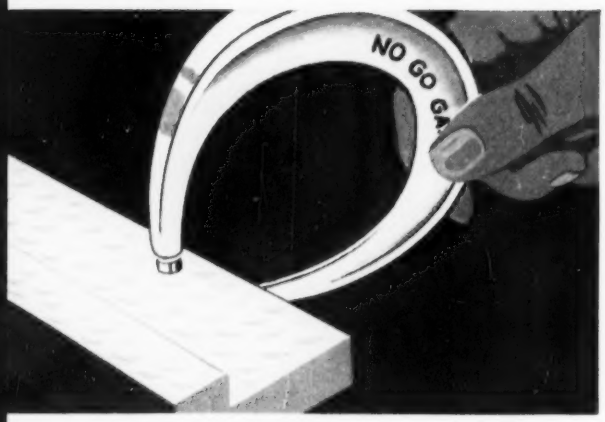
Constant	0.011
Weight, 1 lb	0.000
Reach, 10 in.	0.004
Move, 10 in.	0.005
Min.	0.020

NO. 2

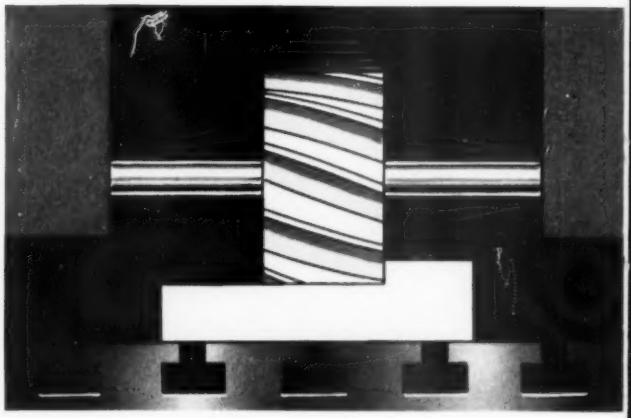
Constant	0.011
Weight, 1 lb	0.000
Reach, 30 in.	0.012
Move, 30 in.	0.016
Min.	0.039

HOW TO END DAMAGED WAYS, PRODUCTION LOSSES

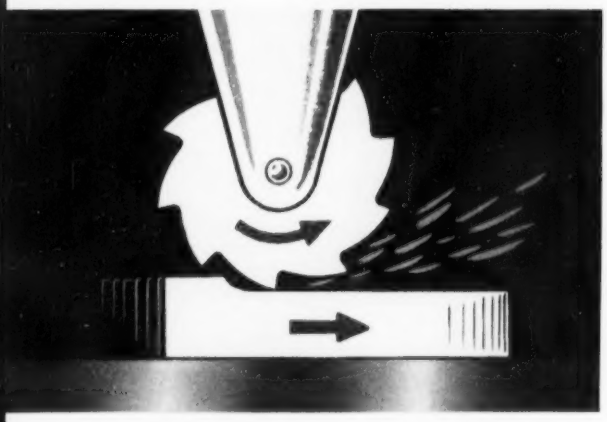
Sunoco Way Lubricant Stops "Jumpy Table"



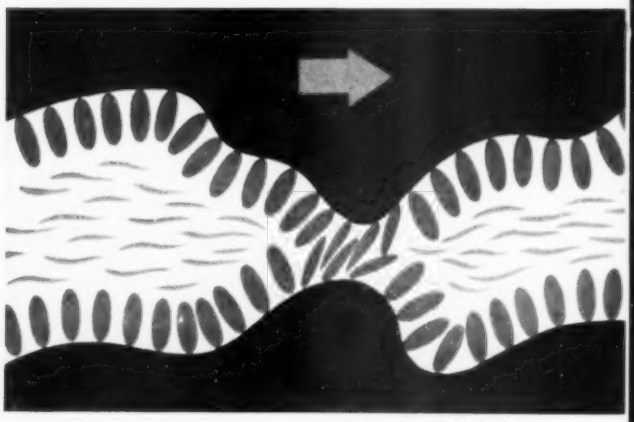
Tool chatter and jumpy table are machining headaches. Too often they cause poor surface finish, failure to hold tolerances, production losses.



Tool chatter is a result of a lack of rigidity in either the machine or the set-up. It is a mechanical problem and no lubricant can lick it.



Jumpy table is a stick . . . slip . . . stick . . . slip action of the table. It is a lubrication problem. Though just as damaging as tool chatter, it is not always detected when the cause of poor surface finishes.



Extreme magnification

Sunoco Way Lubricant cures jumpy table. It contains special compounds that form a film, like the nap of a rug, on the sliding surfaces and minimize the force of both static and kinetic friction.

Why take a chance of damaging your ways? These integral parts of the base casting for your machine are difficult to refinish and costly to replace. For information about Sunoco Way Lubricant, call a Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AM-6.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

SUNOCO

PHILADELPHIA 3, PA. ◆ SUN OIL COMPANY LTD., TORONTO & MONTREAL

Handling Times...III

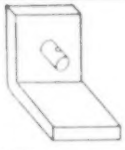
LOADING OF JIGS AND FIXTURES

Normal minutes for loading and unloading five basic types of jigs and fixtures are given below. These times do not include transporting the casting or forging to or away from the jig. These handling times are considered additional and should be calculated by the methods shown under "Handling with Body Travel," page 187 or "Handling Without Body Travel," page 189.

No time allowance is included for clamping or unclamping, because there are too many types of clamping devices to permit setting up times without knowledge of conditions in specific shops. Readers will have to develop these data themselves. Then, too, one hand may be used to operate the clamp and the other to perform some operation on the machine.

PIN-TYPE JIG

(Bushing and bushing plate not shown)



LOADING		UNLOADING	
Part Wt lb max.	Constant	Part Wt lb max.	Constant
5	0.012	5	0.007
10	0.015	10	0.010
20	0.025	20	0.020
40	0.35	40	0.030
Movement on pin—0.0005 per in.		Movement in box—0.0004 per in.	

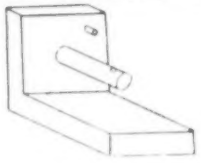
Examples of Loading

A—1-lb casting; 4-in. pin		B—35-lb casting; 16-in. pin	
Constant	0.012	Constant	0.035
Move	0.002	Move	0.008
Norm. Min.	0.014	Norm. Min.	0.043

Examples of Unloading

A—1-lb casting; 4-in. pin		B—35-lb casting; 16-in. pin	
Constant	0.007	Constant	0.030
Move	0.002	Move	0.006
Norm. Min.	0.009	Norm. Min.	0.036

PIN-TYPE JIG WITH LOCATOR



LOADING		UNLOADING	
Part Wt lb max.	Constant	Part Wt lb max.	Constant
5	0.026	5	0.007
10	0.034	10	0.010
20	0.045	20	0.020
40	0.056	40	0.030
Movement on pin—0.0005 per in.		Movement on pin—0.0004 per in.	

Examples of Loading (onto pin)

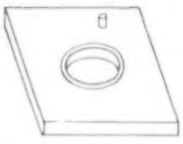
A—3-lb casting; 4-in. pin		B—40-lb casting; 16-in. pin	
Constant	0.026	Constant	0.056
Move	0.002	Move	0.008
Norm. Min.	0.028	Norm. Min.	0.064

Examples of Unloading (off pin)

A—3-lb casting; 4-in. pin		B—40-lb casting; 16-in. pin	
Constant	0.007	Constant	0.030
Move	0.002	Move	0.006
Norm. Min.	0.009	Norm. Min.	0.036

PLATE OR CLEVELAND-TYPE JIGS

(With locator or stop)



LOADING		UNLOADING	
Part Wt lb max.	Constant	Part Wt lb max.	Constant
5	0.010	5	0.005
10	0.019	10	0.008
20	0.030	20	0.019
40	0.040	40	0.029

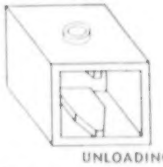
Example of Loading

35-lb casting
Norm. Min. 0.040

Example of Unloading

35-lb casting
Norm. Min. 0.029

BOX-TYPE JIG



LOADING		UNLOADING	
Part Wt lb max.	Constant	Part Wt lb max.	Constant
5	0.015	5	0.007
10	0.018	10	0.010
20	0.028	20	0.020
40	0.038	40	0.030
Movement in box—0.0005 per in.		Movement on pin—0.0004 per in.	

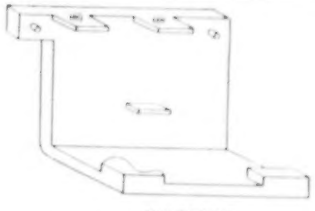
Examples of Loading

A—8-lb casting; 8-in. move		B—32-lb casting; 16-in. move	
Constant	0.018	Constant	0.038
Move	0.004	Move	0.008
Norm. Min.	0.022	Norm. Min.	0.046

Examples of Unloading

Constant	0.010	Constant	0.030
Move	0.003	Move	0.006
Norm. Min.	0.013	Norm. Min.	0.036

VERTICAL OR OPEN-TYPE FIXTURES



LOADING		UNLOADING	
Part Wt lb max.	Constant	Part Wt lb max.	Constant
5	0.029	5	0.007
10	0.037	10	0.011
20	0.048	20	0.022
40	0.060	40	0.032

Examples of Loading

8-lb casting
Constant 0.037
Norm. Min. 0.037

Examples of Unloading

8-lb casting
Constant 0.011
Norm. Min. 0.011

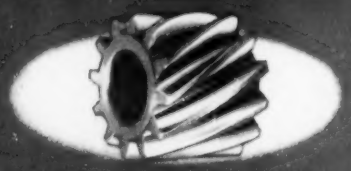
GEARS SHAVED in 12 to 20 SECONDS

Finishing precision gears to close tolerances on tooth profile, index, eccentricity and tooth surface smoothness on Red Ring Shaving Machines is a high production operation as indicated by these random examples.

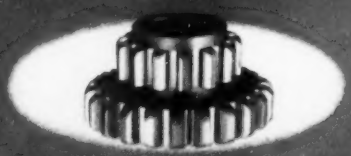
A SHAVING TIME 16 SECONDS

B SHAVING TIME 16 SECONDS

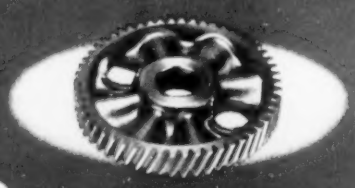
C SHAVING TIME 20 SECONDS



D SHAVING TIME 12 SECONDS



E SHAVING TIME 15 SECONDS



F SHAVING TIME 20 SECONDS

GEAR CHARACTERISTICS

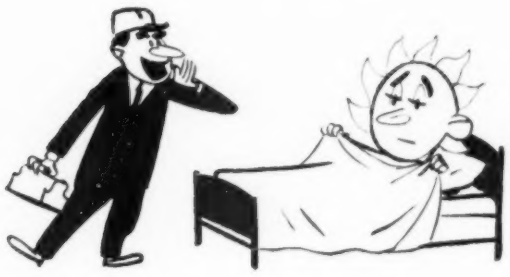
Gear	Stock Removed Over Pins	Material	No. of Teeth	PD	DP	Face Width
A	.010"	Steel	19	2.4"	9.25	⅝"
B	.010"	Steel	29	4.00	9.25	1⅛"
C	.010"	Cast Iron	28	2¼"	10	1⅛"
D	.005"	Steel	12	1⅛"	13.3	1"
E	.006"	Steel	14	2⅛"	6/8	1⅛"
F	.012"	Aluminum	54	5⅛"	10	⅜"

WRITE FOR DESCRIPTIVE LITERATURE ON *Red Ring Gear Shaving*

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.
5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN
WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

TALKING SHOP



Private Time

THE SOVEREIGN STATE of Washington has a law prohibiting daylight-saving time, so Boeing Airplane Co, Seattle, will institute a summer-hours work schedule June 15. All shifts will be moved ahead one hour at employee request. First-shift employees will work from 6:30 or 7 am to 3 or 3:30 pm, second-shift from 3 to 11:30 pm, and third-shift from 11:30 pm to 6:30 am. Arrangements have been made with the Seattle Transit System to provide adequate bus service, and police hail the move as easing the transit problem.

Magnesium Finish Drifts

RECENTLY, a problem arose at one plant in the finishing procedure and resultant painting quality on magnesium parts. For several months, the method employed, insofar as degreasing, cleaning and treating parts and painting and baking operations are concerned, proved satisfactory. Suddenly, and for no apparent reason, completed parts did not pass inspection on paint and finish. At least a month's time was spent in reviewing and checking all operations preparatory to painting and baking. Materials and tools were checked; cleaning solutions and methods were checked; paint specifications, baking oven control, atmospheric conditions, storage facilities, etc, were reviewed for any possible change. No significant change or reason for decline of quality could be discovered. Suddenly, parts again met requirements, and quality perhaps exceeded that experienced formerly. The only reasonable conclusion is that somewhere in the cleaning operations, a variation in quality, immeasurable because of the slight degree of change in any one element but comparatively great collectively, had occurred. In the intensive investigation, all parties concerned increased their efforts and thereby again attained the degree of quality formerly maintained—but nobody knows yet just what slight change caused the trouble.

Precious

SOMEONE told H I Phillips, columnist of the New York *World-Telegram & Sun* that machines reproduce themselves. It moved him to these "precious" lines:

The turret lathe was not herself;
She cooed just like a dove;
So moody was she on the job
It showed she was in love;
The power-press loafed all day long
And seldom did a thing;
The engine-room came to a halt
And murmured, "This is spring!"
The big transformer yawned and
yawned—
The drill-chuck seemed quite flat;
A spindle breathed quite heavily
And whispered, "Love's like that!"...
Outside a trailer smiled upon
A robin by a gate,
And, coming to a sudden stop,
Called loudly to its mate!

March of Progress

A FADED, red, old, wooden building a stone's throw from the Stamford, Conn, town hall is about to be razed. It is the century-old plant of Stamford Foundry Company, that made the pot-bellied coal stove once so familiar in parlors. The 2½ acres on which it stands now looks better as a potential municipal parking lot.

Back in the latter half of the nineteenth century, company products included the monumental self-feeding *Apollo* that stood 6 ft high; the *Duchess*, the *Countess*, and the *Comet*, all made of "smooth castings with polished flanges and nickel mountings." Currently the foundry produces the *Shipmate*, a coal-burning stove for use aboard ship that has been changed but little in design since 1884. Peak in company production was reached during World War I; since then, Mid-West competition has taken over.

Reamer Kicks Up

IN PERFORMING a drill, bore and ream operation on Potter & Johnston automatics, trouble was experienced one morning with the reaming of the hole. This was unusual because, although the part had been in production for some time, there had been no trouble with the reaming; now, the hole was larger on one end than on the other and the finish was very poor. After a number of different reamers had been tried with the trouble persisting, engineers discovered that because of the vibration of the machine, the pilot bar was no longer in line with the pilot sleeve, thus causing the reamer to lift up as it reamed. The bar was centered with the pilot-bar sleeve and tightened securely. All OK.

Suggestive

EMPLOYEES of 14 typical aircraft plants made 16,812 suggestions in 1951, we've just learned from the AIA, netting the suggestors $470,480 and cutting production costs $4.5 million. One out of each four suggestions resulted in a production economy. At one company, supervisors saved an additional $2.3 million in costs through suggestions during the first 11 months of '52 cutting manhours 1,171,550.

News of Metalworking

Exhibits of 340 Manufacturers Draw Record Crowd Of 35,000 to Fifth Materials Handling Exposition

PHILADELPHIA—The largest industrial show of the year, and the biggest ever at Convention Hall, was put on by the 5th National Materials Handling Exposition, May 18-22. Like all such exhibits, this one was bustling and jammed, with upwards of 35,000 taking in the demonstrations of products of 340 exhibitors.

Wares varied from yard cranes, special railway cars, and lift trucks down to rollers for carts, package balers, and labeling machines. Working hours were unusually short—10:30 am to 5:30 pm. Good planning was evidenced by plenty of space for talking and showing in many booths, and by the fact that only a couple of exhibitors were making last-minute adjustments on Monday morning.

Trends

Current trends include a drift toward automotive features in the truck field. Many builders have automatic, hydraulic, or magnetic transmissions or drives, power steering, and more auto-like control panels. A few features in the industry may well be the kind picked up by the auto industry, too; one of these was a new anti-skid device introduced by Yale and Towne—a brake that stops a spinning drive wheel, forcing a tractive wheel to move the truck in mud or snow.

Fork Trucks

Yale & Towne had the center stage of the arena building, giving hourly demonstrations of $100,000 worth of equipment. Big attraction was the Warehouser, a 30-in.-wide electric fork truck with 2000 or 3000 lb capacity that can operate in aisles under 6 ft wide.

Clark had the largest floor area of any of the exhibitors, showing an experimental X-70 lift truck built in the Detroit mode of futuristic prestige designs. It carries load and moment gages, overload-warning signal, synchronized loading lights that follow the load up or down automatically, automatic seat adjustment, two-way radio, and a counterbalanced hood to help maintenance work. Questionnaires were passed out to viewers to get reactions on the features, many of which Clark expects to include in future truck models. Another Clark feature was a simple converter to allow powering a standard gasoline truck with LP gas; two clutchless drives were also shown—Hydratork (hydraulic transmission) and Dynatork (electromagnetic drive for a gasoline truck).

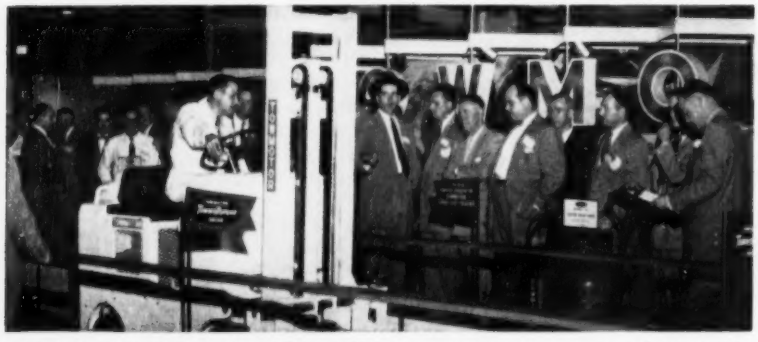
Automatic introduced a new model with "Dynamotive" electric transmission powered by a gasoline engine, intended to give constant power and maintenance economy in the same unit. The electric transmission gives infinite-step transmission without torque conversion or overdrive. An interesting safety feature of the truck is an interlock between the hydraulic service brakes and emergency disk brakes that allows working the emergency brakes with the regular pedal in case of hydraulic failure.

Towmotor's power-assisted steering was demonstrated by turning the wheels from full left to full right with only 6-8 lb of pressure on the wheel. A hydraulic torque converter is also available in Towmotor's line as an accessory.

Hyster showed a straddle truck rated at 30,000-lb capacity for handling stock in yards, and also introduced two new lift-truck models of high maneuverability—the YC-40 (4000-lb load) and UC-30 (3000-lb load) for boxcar, warehouse, and other close-quarter operations. Attachments for special handling jobs, such as cartons, rolls, barrels, and irregular shapes were also demonstrated.

Baker-Raulang's Gas-O-Matic, a gasoline-engine truck with variable-voltage generator and electric motor for power, was shown. The electric feature eliminates clutch, transmission, and gears. Truck-Man announced a lightweight 1500-lb fork truck designed for jobs where low weight loads are necessary because of flooring conditions. Mercury's Yak 430 (AM May 11 '53, p 180) was equipped with Alemite centralized lubrication of bearings, and is set up for lubrication of the trail axle and steering assembly from one point within reach of the driver.

Baker introduced a new three-wheel end-control fork truck, capacity 1500 lb, with 102 in. of lift and tilts of 5° forward and 10° back. This truck steers from a single rear wheel under the driver platform. Moto-Truc has added a two-speed start



TOWMOTOR'S TORQUE CONVERTER, demonstrated on model 460 lift truck, drew interest at ramp display designed to show starting and pulling power. Drive has duplex directional clutch and constant-mesh gear train. Engine can help braking power by reversing

HYSTER claims highest maneuverability for YC-40, with turning radius of 75 in. Unloaded weight on flooring is 164 psi

and stop delay that prevents its walkie trucks from starting and stopping too suddenly. A timer engages a low speed for a few seconds before the truck gets up to full speed. Lift Trucks, Inc, featured a mobile stacker with 2000-lb capacity.

Another Automatic introduction is a 2500-lb, 48-in.-load electric stacker for narrow aisles. The stand-up truck has four wheels, but three-point suspension. Brown-Line showed its Palevator, a vertical skid with rollers on the bottom, designed for picking up ends of crates or boxes in pairs. Advantage over other lifts is that it can get into an 8½-in. space between stacks to pick out load.

Conveyors

Standard Conveyor introduced a traffic-cop switch (mechanical action) that feeds two joining roller conveyors into a single line without allowing parts to bunch. First unit past stop cuts off other roller line until junction is clear. Alvey-Ferguson exhibited live-rail conveyors with standard curves from "A" to "E" and with a wide variety of accessories.

George Koch Sons was showing a magnetic assembly conveyor table made of stainless with a magnetic belt passing under the work area. Magnetic work carriers (table about a foot square) follow the magnetic line. Each work carrier can be pulled from the line for operations on the parts, then pushed back into motion. Carrier Conveyor had a new drive for its "natural frequency" vibrating conveyor, and showed a counterbalancing weight that operates opposed to the drive to minimize vibration transmitted to the floor.

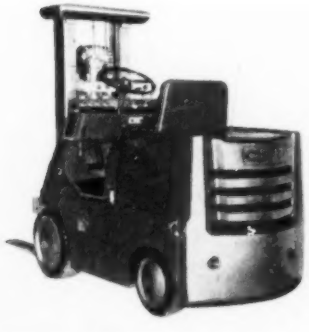
SHOW VISITORS SAW $10 MILLION WORTH OF EQUIPMENT on 170,000 sq ft of floor, largest ever in Philadelphia. Sponsor of the Show was Materials Handling Institute

Rapistan had set up its new spur or Y-switch for connecting a belt conveyor to either of two wheel conveyor lines at different levels. Automatic stops operate on the unused spur to stop goods until the switch is reset for feeding. Erko showed off an all-ball-bearing power conveyor curve for single or multiple turns and inclines. Drive is through sprockets to a flexible chain. Sage turntables exhibited included three new switch types for right-angle or any-angle turns; available for any roller size and frame dimensions. Multiton came out with a roller skid —a steel frame with serrated top that slips under the corner of a load and moves on a series of rollers that project under the frame—like a tank tread.

Other New Products

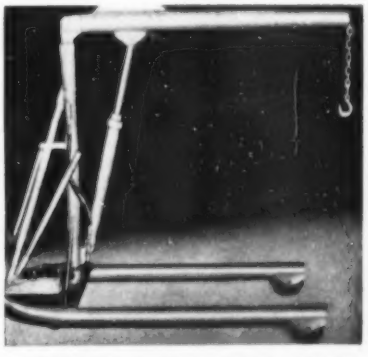
Harnischfeger introduced a 500-in, $199.50 wire-rope hoist with electric power that can operate at 25 fpm. Control is by rope; mechanism operates in oil, and double brakes are included in the unit. Pacific Portable Truck showed a half-ton hoist operated on battery power. This unit may be mounted close to the tailgate of a pickup or similar truck for outdoor operation, using truck-battery power.

Union Metal exhibited a scoop attachment for a lift truck to handle loose or bulk loads. Arms on the



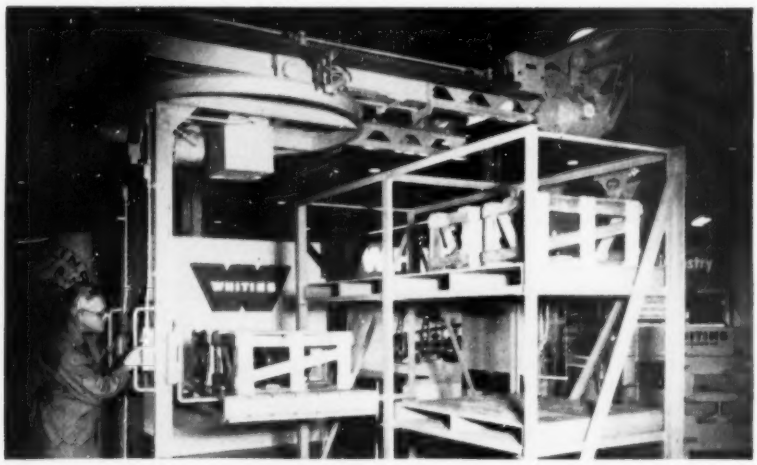
CLARK X-70 is dolled-up test unit; crowd at show was questionnaired for opinions on its special features, not yet on production models

AUTOMATIC "DYNAMOTIVE" power drives electric transmission from gasoline engine, eliminating gearing. New truck design has low center of gravity



RUGER HALF-TON FLOOR CRANE gets into close quarters (3-ft aisle) can turn in its own length; and has hydraulic lift

LEEBAW ASSEMBLE-IT-YOURSELF hand truck meets flexible needs. Joining is with sockets—no hardware required



WHITING STACKER CRANE operates from crane rails; supports work on fork carried by pendant mast. Pushbutton controls operate fork in three directions; mast can rotate through 360°, and can operate in narrow aisles and at any height

scoop attach to the riser members of the truck's lift mechanism to allow tilting the blade down to floor level. Reversing the truck's lift brings up the blade to hold the load until dumped.

Gerrard has added a lever-operated shear to its Bulkbinder steel-strap reel, which features electricity-powered unreeling for any strapping job. The motor drives the strap out on the floor to any desired length. The same company is now marketing Velvet-Strap, a steel band with flocking on one side to protect edges and surfaces of the package being bound.

Rapistan MB wheel for skids and boxes has a replaceable solid-rubber tire, disassembled by loosening four bolts. A new tire can be installed in 3 to 5 min. The wheels are built with tapered roller bearings greased by Zerk fittings. Sizes are 6 and 8 in. dia, rated for 400 and 500 lb. Rapistan also showed a portable aluminum-belt conveyor with a jackscrew for tilting and a choice of wheels or casters for mounts.

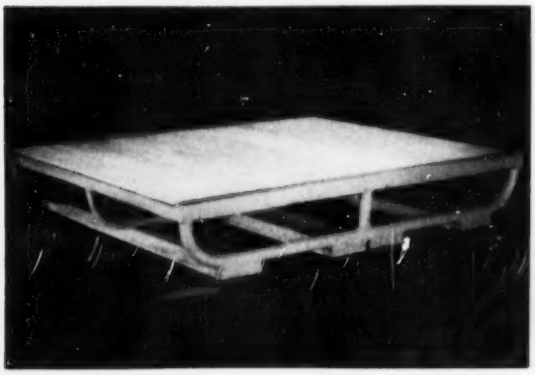
Weber Tag-O-Graph model KC-E was demonstrated at the show. It prints addressed labels up to 100 per min with hand-cut or typwritten stencils, or from a pre-cut die with special information stencilled in on the spot.

Cushman introduced two models of pusher gasoline-engine scooters, called Trucksters. One is a personnel carrier (two riders plus driver), and one is a stake truck for small loads. Speeds run to 30 mph, operating costs to 20¢/hr.

Lambert showed Transitork, a standard fork truck with extra-large wheels, equipped with a number of special attachments—one a unit for handling uncrated and unpalleted goods. The body is hinged to swing up, exposing the entire mechanism for maintenance work. Capacity is 2000 lb at 15 in.

Market Forge trucks shown were unusual for small size and capacities up to 6000 lb (lift truck). Drives are gasoline or electric. Body widths run about 31 in., allowing work in small aisle spaces.

Buda, among a number of other truck makers, demonstrated 2-way radio (General Electric) for controlling lift-truck flow in plants. This is characteristic of a general trend in truck application toward better movement control and better accessory equipment in most lines.



ECONOWELD STEEL-AND-HARDWOOD PALLET is built with steel frame and skids with wooden deck and slats underneath

STAK-MOR PALLETS allow stacking of crushable items and odd shapes; the two-tier pallet is self-supporting. Available in several styles

ALVEY-FERGUSON LIVE RAILS—conveyor sections with rollers—are available as single narrow sections or built-up widths

High Tariff vs. Free Trade Battle Still Going Strong: Decision Soon

WASHINGTON—The battle over US foreign trade policy has reached a crucial state, with hearings completed on the Simpson Bill, designed to replace the present Reciprocal Trade Act.

Both the Eisenhower administration and the Democrats are dead set against the bill's protectionist features. But it's still anyone's guess as to what kind of a bill may become law.

The possibilities:

- **No bill at all.** That would leave it up to the Senate to extend present tariff legislation for a year to keep US international trade treaties from lapsing.
- **An amended Simpson Bill** with some of the protectionist provisions cut out in committee. Even this would face Democratic opposition.
- **A simple extension** of the present Act. Democrats want this.

An important new development in the long-term trade policy picture is Senate passage of a resolution setting up a joint executive-Congressional committee to study foreign trade policy.

Choice of a committee chairman will be the weathervane that indicates how the trade winds blow. If Republican Senators pick him, he'll likely be a high tariff man. If the White House picks him, he'll be at least a middle-of-the-roader. In either event, US trade policy for the next three years will be known soon.

Senate Passes Capehart Bill Extending DPA Powers After June 30

WASHINGTON — As expected, the Senate has passed the Capehart Mobilization Bill (S 1081) extending much of the Defense Production Act after June 30. House Banking Committee hearings on the Bill are ending now.

Limited to Defense Work

The Capehart Bill continues the President's authority to issue priorities and allocations on strategic materials. But it is limited to defense production. The authority cannot be used for civilian production unless:

- The President declares that a material is critical, and that its distribution is vital to national defense.
- Defense requirements cannot be met without dislocation of the civilian market.

Anticipating this, the Defense Production Authority previously announced its Defense Materials System regulations, which set up an allocations and priority scheme for Defense Department and Atomic Energy Commission contractors.

To supplement DMS reporting requirements on metals usage for defense contractors, mobilization officials are working on plans to require periodic reporting by nondefense metalworking companies. They say this would cut down time needed to expand DMS into a full-scale Controlled Materials Plan for both military and civilian consumers in the event of an all-out war.

The Capehart Bill also:

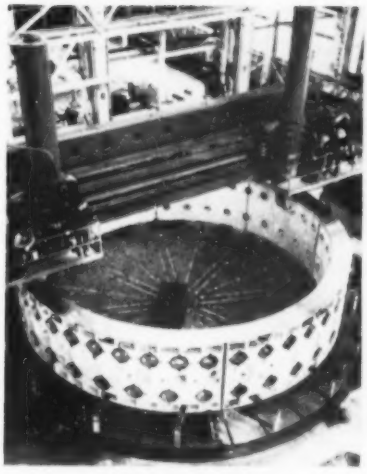
- Extends for two years the President's authority to expand productive capacity through loans, loan guaranties, and long-term purchase commitments.
- Grants the President authority to impose a 90-day freeze on prices, wages and rents at the level prevailing on any day within the preceding 30 days. Nevertheless, Presidential authority under this provision of the Capehart Bill is feeble. He cannot invoke the freeze without approval of Congress.

ASA STUDYING INDUSTRIAL DIAMONDS FOR DEFENSE

NEW YORK—American Standards Association will shortly begin study of more effective use of industrial diamonds in defense production. Participating will be tool engineers, machine tool builders, users, engineering societies and the Armed Forces.

The new project aims at interchangeability of diamond tools and their holders.

Such a large variety of diamond tools and holders have been developed in the past, there is no interchangeability between the parts. The new project is expected to remedy this and eliminate need for large stocks of replacement parts.



BORING 30-FT INSIDE DIAMETER of a stationary frame for the world's largest compressor at Westinghouse Electric Corp's Sunnyvale, Calif, plant. The bore must provide ½-in. clearance for stator blades, which are rooted to an 18-ft diameter spindle. This stator ring is one of 11 Westinghouse is building for five compressors for use in Air Force wind tunnels

ARMY'S ATOMIC CANNON TERMED "WASTEFUL"

WASHINGTON — Army Ordnance's cherished new weapon, the 280 mm atomic cannon, is already under fire. But the barrage is in the form of criticism from other branches of the Service, particularly the Air Force, who contend that the cannon and its use of fissionable material are wasteful.

Word is out that the Army plans to build as many as 100 more atomic cannon, and has earmarked part of the appropriations it seeks from Congress for cannons and shells with atomic warheads.

The Army defends the atomic cannon on grounds that weather, enemy interception and other factors can stop delivery of an atom bomb by plane, but nothing can stop a shell once it is fired, even though maximum range is only 20 miles. And, says the Army, the cannon is far more accurate than a bomber.

Critics of the cannon scoff at this. Tactical targets would almost have to be wasteful, they say. And damage to scattered fortifications, while severe, wouldn't equal that of a bomb.

Impartial observers see it this way: efficient or no, the atomic cannon has a wonderful uplifting effect on Service morale.

Plant Expansion

Zenith Radio Corp plans to spend about $5 million this year on expansion and modernization.

Pennsylvania Railroad will build a $5 million industrial development on an 8-acre tract of land near Frankford Creek, Philadelphia. Manufacturing and processing plants will be among those to be erected.

Douglas Aircraft will spend $1.08 million to convert a World War II aluminum factory at its Torrance, Calif, plant into a modern administration building.

Thomas A Edison, Inc, will expand storage battery manufacturing facilities at its West Orange, N J, plant at a cost of $6 million. The new facilities will step up battery production 40%.

Minneapolis-Honeywell Regulator Co is building a 10,000 sq ft precision switch factory for its Micro Division at Warren, Ill. The new plant, the division's fourth manufacturing operation, will employ about 1500.

Westinghouse Electric Corp will build a new plant for the manufacture and repair of electrical equipment at Atlanta. First phase of a multi-million dollar Westinghouse expansion program in Atlanta, the plant will make power transformers, controls and switchgear.

Worthington Corp, Harrison, N J, is negotiating for a 100-acre tract bordering the Tennessee river at Decatur, Ala, to build a $3.5 million air conditioning equipment manufacturing plant.

Hartford Special Machinery Co will build a one-story, 45,000 sq ft assembly plant in Simsbury, Conn. Plant will employ 100.

Skinner Chuck Co and its **Skinner Electric Valve Division** have completed an 85,000 sq ft straight-line production plant at New Britain, Conn.

Ryerson Steel Co is adding 10,000 sq ft of working space to the Inland Empire Steel Co plant at Spokane, purchased by Ryerson late in 1951. The addition will be used for fabricating reinforcing bars.

MANUFACTURING CATHODE-RAY INSTRUMENTS at Allen B DuMont Laboratories' new Cathode-Ray Instrument Division plant at Clifton, N J. The production floor is laid through the center of the 118,000 sq ft manufacturing building to provide "straight-through" production flow. Instruments are assembled by stages, moving through the production area from the west end, to the testing and inspection installation, then to the shipping department

It's Wilson Vs. the Air Force In Air Program Cutback Controversy

WASHINGTON — The $5 billion slice in new money for the Air Force next year is causing storms of protest on Capitol Hill. Air Force brass and air power advocates are whipping up support in hopes of raising Defense Secretary Wilson's appropriation of $11.7 billion to the $16.8 billion requested by ex-President Truman.

The Air Force is taking a long chance in making an end run around Wilson and the White House. In 1948, it succeeded in getting Congress to raise appropriations $600 million when chances for Truman re-election looked bad. But this time, the Air Force runs the risk of four years of extreme Presidential disfavor.

Crux of the air power cutback controversy is that in 1951 Congress approved a scheduled build-up of air power to reach 143 air wings and 1.1 million men by June 1956. Then Wilson stepped in. He was told by top Pentagon budget experts that there wasn't enough money appropriated to buy the planes the Air Force wanted by the readiness dates. About the best that could be done, they said, is to build up the Air Force to 110 wings by mid-1956.

So Wilson, with National Security Council approval, cut Air Force appropriations by $5 billion, and trimmed its next year's spending by $2.4 billion. In addition, he set the "interim goal" of air power at 120 wings—an increase of about five wings a year—through June 1956.

Just how many planes will not be bought as a result of the budget cut has not been determined yet—they can't be gaged by the number of wings because a superbomber wing may have only 15 planes, fighter wings 75.

Under the Truman program, aircraft and related procurement amounting to $8.9 billion would have bought about 5500 planes. Wilson's $5 billion should thus buy about 3100 aircraft.

Actually, it won't work out this way. Reason is that the Air Force may defer buying trainers, transports and utility types in an effort to emphasize buying of bombers or interceptors.

Since the outbreak of Korea, the US has lost some 3000 planes, equivalent to the entire 1950 production of military planes. On top of this, many planes currently in use are considered obsolete—like the original F-84 and early models of the F-86—and must be replaced with new models.

But the aircraft industry is now producing 14,000 planes a year—enough to compensate for losses and replace obsolete aircraft. Thus, under the Wilson program, the Air Force will be completely modernized by mid-1956.

Stockpiling to Act as Long-Range Stabilizer for Metal Market

WASHINGTON—The government's strategic metals stockpile was never intended as a prop for sagging metal markets. But twice last year, stockpile buyers stepped into the market to halt price slides in lead and zinc.

Now, under provisions of a bill extending much of the Defense Production Act for two years, the President will have authority to transfer to the stockpile metal acquired by the government through its floor-price commitments. In effect, the stockpile thus becomes a long-range stabilizer for the metal market.

The floor-price commitment has been the government's major incentive for boosting production of strategic and critical metals and minerals. The Defense Procurement Agency has underwritten about $4 billion output with this device. The contract terms: if producers are unable to sell on the open market at floor price, the government is obligated to buy the metal.

In today's declining metal markets, many floor prices have become premium prices. Examples: 17¢ lead and zinc, 33¢ copper.

Office of Defense Mobilization estimates that up to 20% of the $4 billion gross commitment might be put to the government. "PUNC" (capital jargon for "possible ultimate net cost") of this surplus tonnage to the government is figured as at least $560 million.

Stretchouts in the defense buildup have underscored this potential headache: What will the government do with premium-price metal it might have on its hands, especially when tonnage exceeds stockpile requirements, during the five or more years the purchase commitments run?

These are the possibilities

- Government could cancel the purchase contract, then compensate the producer.
- Or worse (for metals producers), the government could dump the support-price metal on an already-depressed market.

The new provision authorizing transfer to the stockpile, regardless of stockpile goals, is obviously the easiest way out, and would also prop up copper, lead, zinc and other metal prices.

According to Office of Defense Mobilization plans, the surplus tonnage will be put in the stockpile without being charged to the $457.6 million unobligated stockpile funds. Instead, equivalent Treasury Department borrowing authority, under which the expansion plan has been financed, will be canceled out.

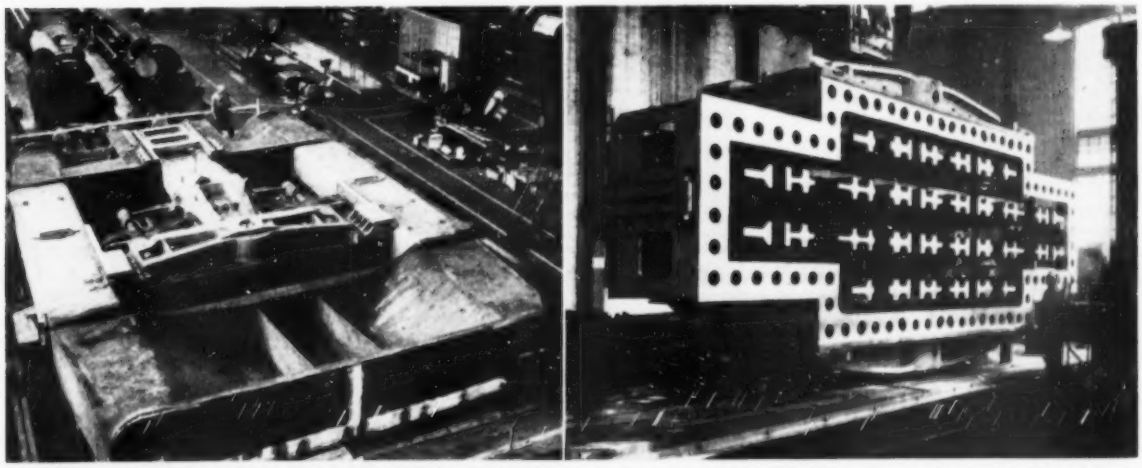
Business Items

General Electric Co's Welding Department will be transferred to York, Pa., by the end of March 1954. The planned transfer from Fitchburg, Mass., where the Department has been located since 1946, to York will give the Department a chance to expand and will also give General Electric's Small Turbine and Supercharger Department, located in Fitchburg, room for predicted production increases. The Welding Department will move into the York plant formerly occupied by G-E's Wire & Cable Division, which is being moved to New England.

Eutectic Welding Co has formed a Canadian sales and service subsidiary, **Eutectic Welding Alloys of Canada, Ltd,** with offices in Toronto and Montreal, and representatives in Dartmouth, Nova Scotia; Regina, Saskatchewan; Edmonton, Alberta; Vancouver, B C.

Hydraulic Press Mfg Co, Mt Gilead, Ohio, is opening a manufacturing center for production of hydraulic presses, plastic molding presses and die-casting machines in conjunction with the plant of **GEBR Stork & Co,** Hengelo, Netherlands. Hydraulic Press Mfg Co's subsidiary, **Hydraulische Pers Maatschappij Nederland, N V,** will handle sales, service and manufacturing of these products for distribution to Western Europe and other territories.

Thor Power Tool Co's Buffalo office has moved into new quarters at 735 Military Road.



ASSEMBLING AN 8000-TON TRIPLE-ACTION HYDRAULIC PRESS at Bethlehem Steel Co's Bethlehem, Pa., plant. Crown, draw slide and bed were designed by Birdsboro Steel Foundry & Machine Co, shipped to Bethlehem for machining and fabricating and preliminary assembly (left). The press was then dismantled and shipped to Lockheed Corp in California to be used in stamping out stiffened airframe sections. Right: viewed in partial assembly, the press's draw slide presents an unusual pattern. Face of slide is machined to receive a bolster plate

Distributors Named

Clearing Machine Corp has named **Harry P Leu, Inc,** Orlando, Fla, as its Florida representative, and **Shop Supply Co,** Birmingham, as its Alabama and Mississippi representative.

Stamco, Inc, New Bremen, Ohio, has named **Luther & Pedersen, Inc,** 565 W Washington Blvd, Chicago, as its representative in the Chicago-Milwaukee area for its line of metal shearing and slitting equipment.

Columbia Tool Steel Co, Chicago Heights, Ill., has named **A J Rod Co, Inc,** 5011 Navigation Blvd, Houston, as its Texas territory sales representative.

Peter A Frasse & Co, Inc, which has for many years maintained a sales office in Hartford, Conn, serviced by its New York warehouse, is constructing a new office and warehouse in Hartford to distribute alloy, stainless and cold-finished carbon steels.

A O Smith Corp's Welding Products Division has appointed three new distributors: **Pensacola Welding Supply, Inc,** Pensacola, Fla; **Worland Oxygen Co,** Worland, Wyo; **Guilford Welding Supply Co,** Baltimore.

Firth Sterling Inc, announces the opening of a branch office at 1102 Prudential Bldg, 1100 Holcombe Blvd, Houston, Texas. Robert B Lewis will be manager, Charles A Hartwell will be office manager.

Kurt Orban Co, Inc, New York, has named **Miner Machine Co,** Denver, as distributor for its line of German-made machine tools in Colorado, Wyoming, Utah and New Mexico.

Materials Handling Products Corp, Syracuse, N Y, has been named distributor for **Yale & Towne Mfg Co's** industrial trucks.

Utica Drop Forge & Tool Corp has appointed **D James Murray Co,** 308 9th Ave North, Seattle, as sales representative for its tools in Washington and Oregon. The Murray organization will work with **Gardner Distributing Co,** of the same address, which will stock the tools.

R E Brooks Co, Hasbrouck Heights, N J, has been named northern New Jersey sales and service representative for **Hyster Co's** industrial trucks.

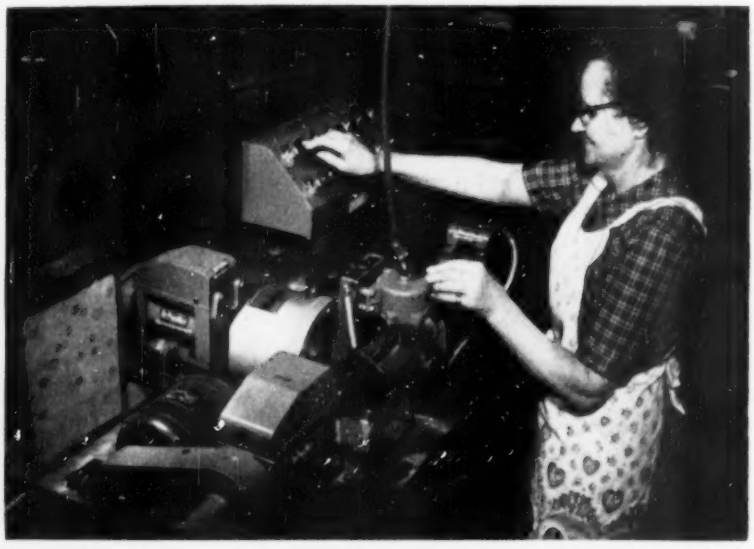
NEW EASTERN MACHINE TOOL SALES CENTER is being built at 25 Beechwood Ave, Mount Vernon, N Y, by Harrington Wilson Brown Co, Metropolitan New York distributors. Scheduled to open in July, the two-story building will house the company's offices and a showroom, where the products of some 19 machine tool builders will be displayed

Westinghouse Tool Electrification Caravan Gives Automation a Lift

PITTSBURGH — Automation on wheels is the theme of a display coach currently on tour of machinery manufacturing plants throughout the country. Sponsored by Westinghouse Electric Corp, the coach combines an auditorium and exhibit hall on wheels to show how line starters, control stations, motors and circuit breakers can be used to achieve successful automation in the metalworking field.

The coach is taken to a customer's plant, where consecutive 1½-hr programs are run for groups of 10-12 engineers at a time.

Highlighting the introduction of the program are films featuring Tell Berna, general manager, National Machine Tool Builders Association, on "Automation Mechanics," and Burnham Finney, editor, AMERICAN MACHINIST, on "Automation Economics." Following this, visitors are shown animated displays on current automation practices. It is expected that the coach will visit 350 US plants in the next 14 months.



MULTIPLE-SPINDLE DRILL HELPS CUT CAMERA PRODUCTION COSTS. By replacing a row of 14 drill presses with this multiple spindle, eccentric plate-operated drill to produce 38 holes in its model C-4 camera case, and by making other sweeping improvements in production methods, Argus Cameras, Inc, Ann Arbor, Mich, has been able to cut the price of C-4 cameras from $99.50 to $89.50

Donald M Laflin

E L McFerren

M H Nichols

D F Robinson

Names in the News

Donald M Laflin has been named vice president in charge of sales at Giddings and Lewis Machine Tool Co, Fond du Lac, Wis. Mr Laflin has been a member of the company for 20 years. His first assignment was Eastern district sales manager, and in 1949 he was made general sales manager and held this position until his recent appointment. **Edgar L McFerren,** former chief engineer, has been appointed vice president in charge of engineering. He has been with Giddings and Lewis for 17 years and has held many positions within the company. **Milton H Nichols,** former Northeastern district sales engineer, has been made export sales manager and will be located in Paris. **David F Robinson,** former vice president and sales manager of Rudel Machinery Co, Inc, New York, has been named Northeastern district sales engineer. Other appointments in the company are: **Ralph A Breitung,** secretary and treasurer; **Morton R Swift,** controller, assistant secretary-treasurer; **Fred C Freund,** works manager; **William H Sorenson,** assistant to the president; and **Harry C Soukup,** superintendent.

Thomas T Kling, who will continue as works manager for Lodge & Shipley Co, Cincinnati, has been elected vice president and a director. Mr Kling started with Lodge & Shipley in 1928 as a University of Cincinnati co-op student.

Carl M Beach, domestic sales manager for Cincinnati Milling Machine Co, has been named vice president and director of its sales subsidiary, Cincinnati Milling and Grinding Machines, Inc. Mr Beach joined Cincinnati Milling Machine in 1929 as a co-op student.

O R Robertson, formerly of Western Electric Co, has joined the engineering staff of Wysong & Miles Co, Greensboro, N C, metalworking machinery firm. He was formerly with Fairchild Aircraft Corp.

John Jay Hopkins, board chairman and president of General Dynamics Corp, New York, was recently elected chairman of the board of Consolidated Vultee Aircraft Corp, San Diego, succeeding **Floyd B Odlum,** president of Atlas Corp.

Steven P J Wood, vice president of Warner Electric Brake and Clutch Co, Beloit, Wis, has been elected president of the company. Mr Wood joined Warner in 1946 after five years' Army service, and in 1947 was made general sales manager.

James A Roemer and **John J Kraus** have been named vice presidents of Sharon Steel Corp. Mr Roemer has been operating head of the company's Niles Rolling Mill Division since its inception in 1935. Mr Kraus has been general manager of Sharon's Detroit Tube and Steel Division, as well as Detroit district manager for Sharon.

Herbert P Buetow, executive vice president in charge of finance, has been elected president of Minnesota Mining & Mfg Co, St Paul, Minn, succeeding **Richard P Carlton,** who becomes vice chairman of the company's executive committee.

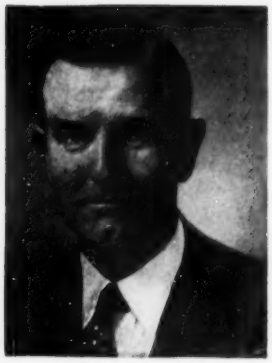
Thomas T Kling

Carl M Beach

O R Robertson

H P Buetow

Robert F Smith



Thorn L Mayes

T E Donohue

G E Stringfellow

Names in the News

Robert F Smith, vice president and, for the last several months acting chief executive of Indiana Steel Products Co, Valparaiso, Ind, has been elected president of the company and a member of the board of directors. **Ivan A Dickey,** assistant sales manager, has been named sales manager, and **P M Wheeler** has been appointed Midwest sales manager.

William S Snead has been elected president and chairman of the board of Emerson Electric Mfg Co, St Louis. New executive vice president is **John A Driy.**

A A Zuber, former vice president and director of Carver Pump Co, Muscatine, Iowa, has been named general manager of W A Sheaffer Pen Co's new Tool and Die Division, Fort Madison, Iowa. Appointed assistant to Mr Zuber is **Les Hall. Ross Franklin has** been appointed designing engineer.

Thorn L Mayes is named general manager of General Electric Co's new Small Integral Motor Department, now operating at Lynn, Mass, but scheduled to move to Fort Wayne, Ind, this fall. Also named to the staff of the new department are: **L Dean Fowler,** manager of marketing; **Oscar L Weitzman,** manager of manufacturing and employee relations; **J Herbert Behm,** manager of engineering; and **Martin L Kresge,** manager of finance. Mr Mayes was formerly manager of engineering at G-E's Lynn, Mass, motor plant.

Charles M Norlin has been appointed regional manager for All-State Welding Alloys, Inc, in Michigan, Indiana and Illinois.

Clarence J Johnson, corporate secretary of American Machine & Foundry Co, has been elected secretary and a director of Thompson-Bremer & Co, Chicago, an AMF subsidiary.

T E Donohue has been appointed sales manager of Cleco Pneumatic Tool Division, Reed Roller Bit Co, succeeding **W J Vossbrinck,** who has resigned to form his own company. Mr Donohue joined Cleco in 1948 as assistant sales manager.

George E Stringfellow, senior vice president and a director of Thomas A Edison, Inc, has been named manager of the company's Ediphone Division, in addition to his present duties as manager of its Storage Battery Division. Mr Stringfellow succeeds **C T Jacobs,** who continues as a vice president of the general division of the company.

Erhardt C Koerper has been named works manager for Ampco Metal, Inc, Milwaukee. Mr Koerper was formerly assistant executive engineer for A O Smith Corp.

Paul A Metzger, for 27 years with General Motors Corp's Frigidaire Div, has been named to the newly created position of materials manager for Servel, Inc.

A Francis Townsend, executive engineer, Heald Machine Co, Worcester, Mass., who has been named vice president-engineering as announced in AM May 25, p171.

Lawrence H Cousineau, assistant treasurer, who has been appointed to additional duties as vice president-sales of Heald Machine Co as announced in AM May 25, p171.

Roger S Pyne, sales manager of Van Norman Co's Machine Tool Division since 1949, named vice president in charge of the Division, as announced in AM May 25, p171.

Grayson M Stickell, who was recently named general manager of Landis Machine Co, Waynesboro, Pa, in addition to his present duties as vice president of the company.

John C Hanna

R F Baird

Seibly S Buffum

Elwood R Quesada

John C Hanna, vice president, Hanna Engineering Works, Chicago, has been elected chairman of the newly formed National Fluid Power Association, made up of manufacturers of such fluid power components as hydraulic and pneumatic valves, cylinders and pumps. Also elected were **B N Ashton,** president, Electrol, Inc, Kingston, N Y, first vice chairman; **John E Erskine,** vice president, Racine Hydraulic & Machinery, Inc, Racine, Wis, second vice chairman; and **E G Peterson,** President, Hannifin Corp, Chicago, treasurer. **Col. Barrett Rogers,** industrial management consultant, has been named executive secretary of the Association, which has its headquarters at 1618 Orrington Ave, Evanston, Ill.

Harry P Smith, Jr, has been appointed executive vice president and general manager of operations, Hufford Machine Works, Inc, El Segundo, Calif. He started with Hufford at its inception in 1942, advancing to sales manager. Also named were: **Walter G Wheeler,** vice president in charge of engineering and production; **Kingsley Drone,** chief engineer; **N T Harty,** secretary-treasurer; **A R Colles,** controller and assistant secretary-treasurer; **William Kahler,** plant superintendent; and **Clifford Horton,** chief of production planning and scheduling.

R Paul Toeppen has been elected vice president of James H Knapp Co, Los Angeles designers and manufacturers of industrial furnaces. Mr Toeppen has been general manager for the last 10 months.

D R Strouse has been named production manager of Tube Reducing Corp, Wallington, N J. Mr Strouse, who was formerly head of production control for Morse Twist Drill & Machine Co, joined Tube Reducing as an engineer in January.

R F Baird has been appointed vice president and general manager, and **Seibly S Buffum** sales manager of Aircraft Metal Forming Co, Inc, Burbank, Calif. Mr Baird was formerly with Petley, Inc, Los Angeles, for five years and at one time was chief engineer of Chrysler Corp Airtemp Division's sheet metal cabinet division. Mr. Buffum, formerly with McCarty Co as engineering consultant, has just returned from the Marines.

Humbert C Cozza, Jr, who joined Blaw-Knox Co's Lewis Machinery Division in July after serving with manufacturing firms in Mexico, has been named manager of industrial engineering. **John A Deer,** production manager since 1947, has been appointed manager of production planning and control.

Joe R Horton, since 1927 active in aircraft manufacturing and with the Civil Aeronautics Administration, has been appointed general foreman of Marquardt Aircraft Co, Van Nuys, Calif.

Gage Irving, manager of Consolidated Vultee Aircraft Corp's Guided Missile Division, Pomona, Calif, has been granted an extended leave of absence because of ill health. During his absence, Convair Executive Vice President **J V Naish** will assume Mr Irving's duties in addition to his own.

J Harold Campion has been named assistant plant superintendent at Fairmount Steel Corp, Philadelphia. Mr Campion was formerly superintendent of heat treatment and production at Midvale Steel Co. Also named to a new post is **M Masters,** formerly production manager, as chief of estimating, process engineering and production planning.

Lt Gen Elwood R Quesada, USAF (Ret), who commanded the Ninth Tactical Air Command and the Ninth and Twelfth Fighter Commands in World War II, has been elected a member of the board of directors of Lockheed Aircraft Corp, Burbank, Calif. General Quesada resigned from the Air Force in 1952 to become vice president and director of Olin Industries' Pulpwood Division, East Alton, Ill.

David Mayers has been appointed manager of the Trentwood Works of Kaiser Aluminum & Chemical Corp, near Spokane, Wash., succeeding **A H Branstad,** who has transferred to Oakland, Calif, as manager of Kaiser fabricating operations.

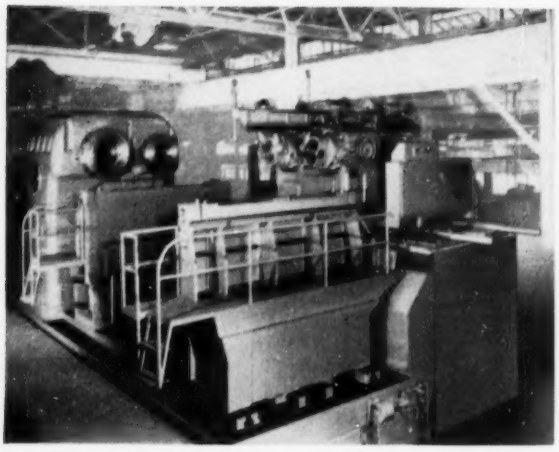
Lloyd L Hill has been appointed vice president and general manager of Summers Gyroscope Co, Santa Monica, Calif. Mr Hill was formerly controller and assistant to the general manager.

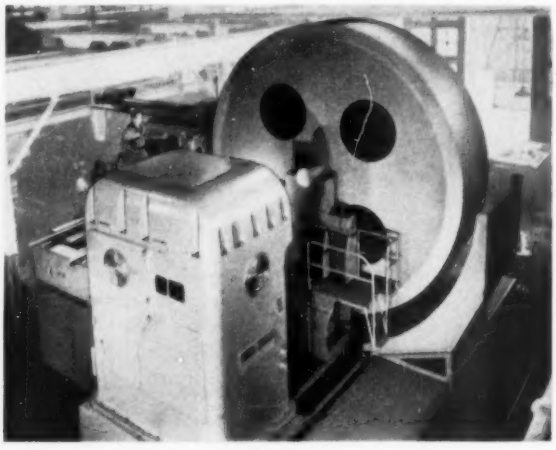
OBITUARIES

Walter P Zagar, 65, who started Zagar Tool, Inc, in his garage in 1939 and built it into a million-dollar corporation, died April 23 in Cleveland. Mr Zagar had been a machinist for 25 years with White Motor Co when he received an order for a special machine. Mr Zagar's son, Frank, and his wife, Rosalia, assisted him in producing the machine, which was the start of Zagar Tool, a firm now employing 130 people.

Harold W Force, 74, former president of California Corrugated Culvert Co, Berkeley, and retired since his firm was sold to Armco Drainage and Metal Products Co to become its Calco Division, died May 12 in Oakland.

New Shop Equipment





National Broach Horizontal Gear Shaver Handles 2½- to 15-ft-Diameter Gears

Gear-shaving machine now completed by National Broach & Machine Co is capable of handling gears with PD of 15 ft. With certain modifications, work gear diameters could be increased to 16-2/3 ft. The machine is built for horizontal-axis shaving with the work rotating in journal bearings as it is when assembled.

Principle elements of the machine are the base, the pedestals, the headstock, the saddle, the cutter-head assembly, and the journal alignment checkers.

Base carries the work-drive headstock and two adjustable pedals at its front end. Rear part carries the saddle assembly which is power-positioned.

Two pedestals carry journal bearings supporting the work-gear shaft which is driven through a flexible coupling by the headstock spindle. Pedestals may be power-traversed in line with the gear axis and also adjusted perpendicular to it. Each pedestal has an operator's platform.

Headstock is a one-piece casting with two spindles having 40 in. between centers. One spindle is for large gears, the other for small, and they are protected against simultaneous operation. Drive motor, rated 25 hp, is carried in ventilated compartment at base of headstock.

Saddle is equipped with two-speed, reversing, drive motor. The operator's platforms on either side of the saddle travel with it, but the weight of platforms and operator is taken directly by separate roller rails. Saddle-feed screw is anchored at both ends and the nut is lubricated by a separate constant-level oiling device. Signal lights indicate direction of saddle feed.

Cutter-head assembly includes two cutter slides with the journal-alignment checker between them. Each cutter slide is provided with power traverse to bring it into approximate shaving position. The crossed-axes setting of each cutter head is made by adjustment crank and vernier scale. A dial indicator is used for final setting. The two cutter units facilitate handling of herringbone gears, a type most often encountered in large marine gears.

Journal-alignment checking bar is carried between the cutter slides; a vertical arm at the front of the bar has two gaging buttons which actuate a dial indicator. One button checks vertical alignment, the other horizontal. The checking bar is advanced or retracted by a handwheel and pinion which bridges the bar.

The gear shaver is 24 ft long, 25 ft wide, and, with work gear, rises 18.5 ft from its foundation. Accuracy claimed for properly hobbed gears is a 0.0003-in. error in pitch or index and a tooth-profile error of 0.0002 in.

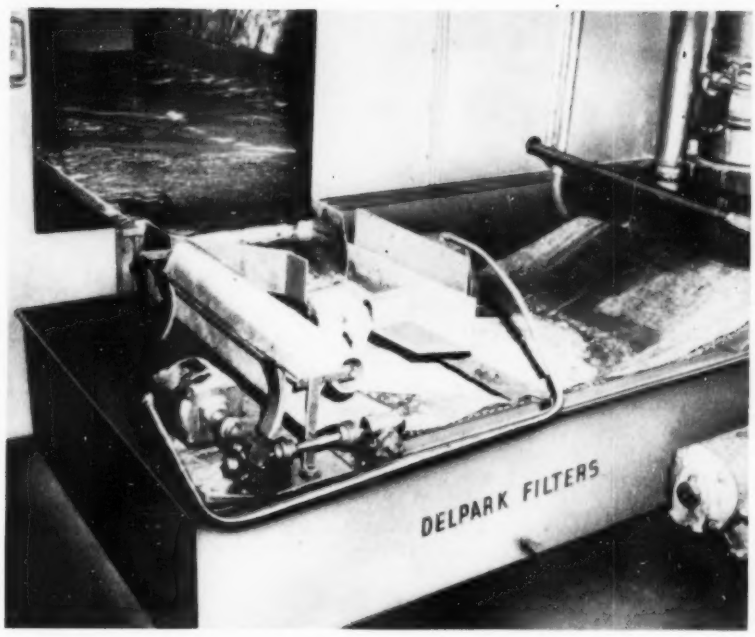
National Broach & Machine Co, 5600 St Jean Ave, Detroit 13, Mich

Attachment Converts Rotary Drill to Thrust-Action Saw

E-Z Way Tool Co has developed a cam-action saw attachment to convert the rotary power of an electric drill to a thrust-action saw, completely eliminating gears. Tool can be attached directly to any heavy-duty drill. Each revolution of the power drill is turned into a ⅞-in. stroke. The attachment weighs 3½ lb.

E-Z Way Tool Co, Barrington, Ill

Materials and Parts



Delpark Filtration System For Paint Spray Booth Water

Automatic skimming and either intermittent or continuous filtration are features of the Delpark system developed by Delpark engineers with the cooperation of plant engineers in automotive industries where the system was installed and studied.

Proper use of compounds will flocculate over-sprayed paint particles into a floating matte. Complete and continual removal of this matte is necessary before it begins to settle to the bottom of the tank. Several automatic skimming methods are in use and Delpark consultants will suggest the most satisfactory for a particular application.

The filter is a continuous, self-cleaning, gravity unit. Paint is discharged, in a relatively dry state, into an outside container. Filter material rests on, and conforms to, a flat, endless conveyor of open construction. Sloping sides form a shallow pool of the conveyer and an inclined discharge ramp enables removal of the filtered paint.

When flow of filtered water through the material is reduced by paint collected on the surface of the material, the water level rises and actuates a float-switch which moves the filter material forward and brings clean material under the incoming flow.

Industrial Filtration Co, Lebanon, Ind

Porter-Cable Table For Portable Electric Saw

Rigid steel table with angle gage converts a portable electric saw into a table saw. The inverted saw is mounted to the underside of the table with the blade protruding through a slot. Depth and angle of cut are adjusted by controls built into the saw itself. (Table will accommodate any of seven Porter-Cable handsaws.) A calibrated angle gage rides in a slot parallel to a fence and assures accurate cutting. The 18x21-in. table is zinc-plated.

Porter-Cable Machine Co, 20 Exchange St, Syracuse, NY

...INCLUDING

Six-spindle automatic bar machine eliminates changeable cams and provides for over-indexing the spindle drum. page 206

Direct-reading instrument measures radial play in ball bearings without using masters. page 207

Packaged semi-automatic plating system designed to replace or augment still tank plating. page 208

Knee-type milling machine features pushbutton selection of 42 speeds and 50 feeds. page 214

Aluminum extrusion press permits loading billet and dummy on single forward stroke of main ram. page 216

Grinding wheel consists of hundreds of individual abrasive cloth leaves sealed to hard core. page 218

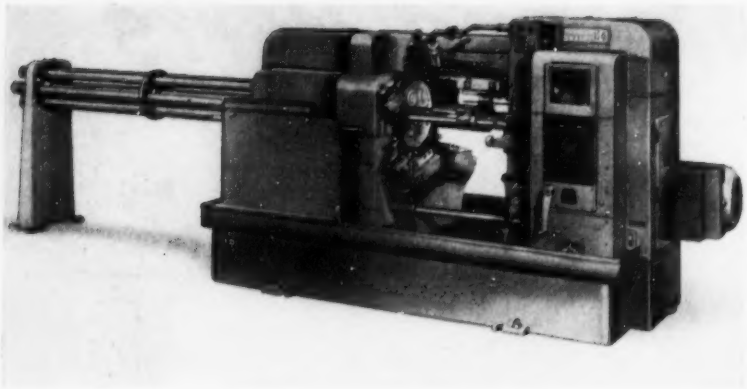
Power nibbler will bead, fold, cut straight or circular lines, slots, and louvers. page 220

Hydraulically controlled machine bores and internal profiles engine parts. page 222

...and in June 22

Horizontal boring and milling machine has gear drive for roughing and belt drive for finishing.

Contour duplicator with electronic sensing element and brain attaches to machine tool leadscrew.



Warner & Swasey Adds Smaller Automatics To Its Line

Automatic bar machines with ¾- and 1-¼-in. capacities possess the rapid set-up and precision working features of Warner & Swasey larger models. The same quadrant mechanism eliminates changeable cams; feed strokes are set by positioning trip blocks on calibrated quadrant scales.

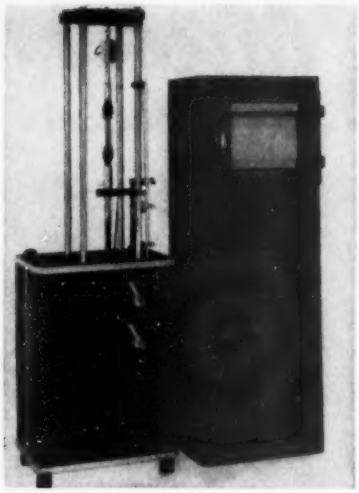
The machines incorporate elliptical-eccentric gears to power the Geneva indexing mechanism. Provision is made for over-indexing the spindle drum so that a latch drops into position at the proper point and a toggle-operated locking slide back-indexes the drum about 1/16 in. against the latch.

Equipped with six spindles, the automatics have a speed range of 255 to 2781 rpm for the 1¼-in. model and 372 to 4045 rpm for the ¾-in. model. Turning stroke is infinitely variable from 0 to 5 in.; max length turned is 8½ in. standard, and up to 10 in. special. Bar feed stroke is infinitely variable up to 10 in.; cross-slide stroke from 0 to 13/16 in.

Machines are powered by a 20-hp, 1750-rpm motor. Coolant capacity is 120 gal.; free-circulation reservoir capacity, 7 gal.; lubrication reservoir capacity, 6 gal.

Length of machines is 11 ft 2 in.; width, 4 ft 6 in.

The Warner & Swasey Co, 5701 Carnegie Ave, Cleveland 3, Ohio



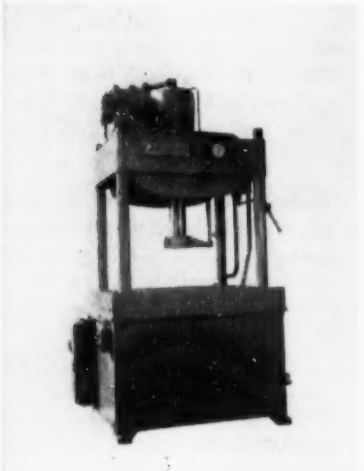
Electro-Hydraulic Tensile Tester

Thwing-Albert Instrument Co announces its electro-hydraulic tensile tester available with full-scale load ranges from 5 gr to 5000 lb. Rates of extension from 0.1 to 20 ipm are standard. Special ranges from 0.2 to 250 ipm provided.

The hydraulic drive system provides constant rates of elongation that are infinitely adjustable on a throttle dial. The drive system has low inertia and performs without overshoot at high speeds.

The electronic recorder and controls are ina separate cabinet.

Thwing-Albert Instrument Co, Penn St at Pulaski Ave, Philadelphia 44, Pa.



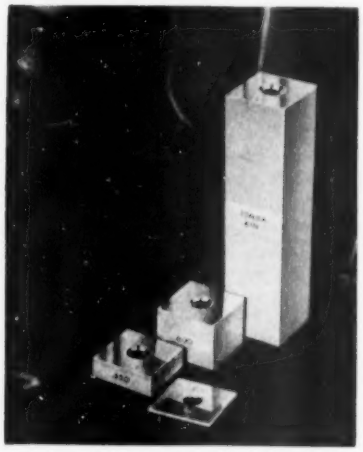
Greenerd Adds 50- and 75-Ton Presses to Line

Greenerd hydraulic presses are now being built in 50- and 75-ton models. Both the H-50-4 and H-75-4 units are four-posted.

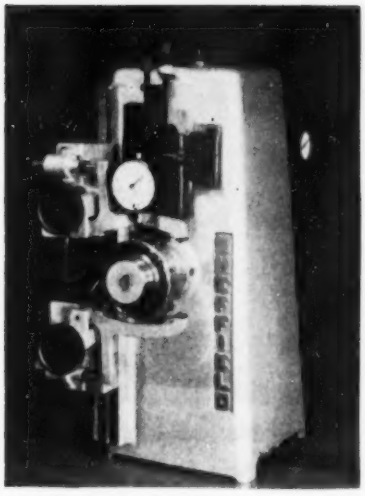
Cylinder is a separate unit, equipped with piston and piston rings; Ram is packed with chevron-type packing in bronze gland. Rapid traverse operates at 1000 psi. Work speed is higher pressure by booster, giving higher tonnage with low hp input. Welded base is also the oil sump.

Ram speed of the 50-ton model is 0 to 16½ tons, 92 ipm; 16½ tons to 50 tons, 30 ipm; Return speed, 150 ipm. Equipped with a 7½-hp 1200 rpm motor. The H-75-4 has a ram speed down 0 to 25 tons, 92 ipm; work speed 25-75 tons, 30 ipm; return speed, 150 ipm. Clearance between 3½-in. tierods left to right, 36 in., front to back, 25 in. The 5-in.-dia hardened and ground ram with removable nose has a stroke adjustable to 12 in. Work surface of the table is 36 in.; daylight, 20 in.

Greenerd Arbor Press Co, Nashua, NH



SQUARE GAGE BLOCKS, available in steel, carbide, and chrome carbide, have been added to the Fonda products. For easy identification, number is located on a ground band on sides of larger blocks, and etching near the edges of gaging surface identifies smaller units—*Fonda Gage Sales Corp, 38 Broad St, Port Chester, NY.*



Sheffield Radial Play Measuring Instrument

Pivotal-arm radial-internal-clearance measuring instrument may be used on production basis or to set up control before bearings are assembled. The instrument features two adjustable, pivotal, load bearing arms that alternately exert upward and downward pressure on the bearing. At the same time it measures the successive movements of the outer ring to determine the amount of radial play of the bearing in that position.

Other features include: automatic shakedown of balls into bottom of groove; direct reading without use of masters; three-station pedal control of load-bearing arms; changeable arbors that correspond to ID of a bearing's inner ring; and Sheffield Guidegage to facilitate slipping bearing on and off the arbor.

Plunjet and Precisionaire may be used instead of dial indicators.

The Sheffield Corp, Dayton 1, Ohio

Bench End-Finishing Machine Cuts Costs, Speeds Operation

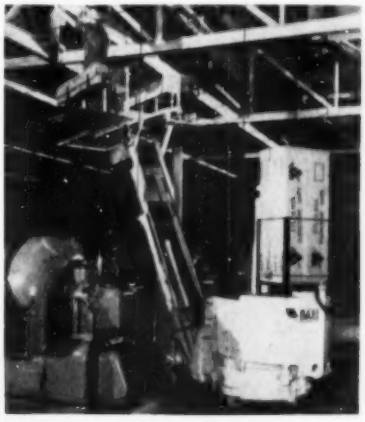
Bench model end-finishing machine has been designed to speed rod pointing operations. In one instance of its use, work is being handled 40% faster than by previous methods, and labor costs per 100 pieces have been reduced from 51 cents to 23 cents.

Machine is equipped with a foot-controlled air cylinder. Operator depresses an electrical foot control which starts an automatic clamp and feed cycle. Work is fed to rotating cutters held in the main spindle behind chuck jaws. When pointing operation is completed, chuck automatically returns work and unclamps. Operator's hands are always free for faster handling and loading. Automatic swing stock stop enables fast positioning of the work in open chuck jaws.

For short-run work, standard model Pines No. 600 machines without air cylinder are available; manually operated lever is used. With either model it is possible to ream, bore, and face tube and pipe ends, center-drill bar stock, and chamfer or form rod ends.

Bench-mounted unit handles any length of stock up to 2 in. in diameter. It weighs 170 lb, is equipped with a ½-hp motor and two-step sheave which furnishes eight different speeds from 760 minimum to 3920 maximum rpm. Larger machines with capacities for heavier work up to 5 in. dia are also available.

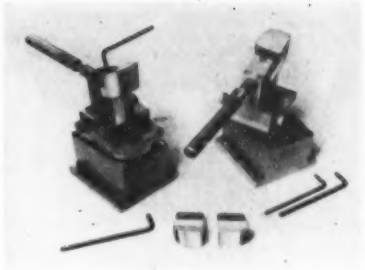
Pines Engineering Co, Inc, Aurora, Ill



Lift-A-Loft Unit Cuts Maintenance Cost

Lift-A-Loft was developed to cut the number of men required for overhead maintenance to one. The unit enables the man to reach ceiling objectives quickly and safely, with a minimum of disturbance to production workers. The fully raised platform of the unit is 12 ft 8 in. above the floor. Unit is battery powered.

Barrett-Cravens Co, 4609 S Western Blvd, Chicago, Ill



Radius Grinding Fixture For Journal Bearing Surfaces

Radius grinding fixture has been developed for redressing radius tools of the serrated inserted type used for finishing axles with ⅛- to ¾-in. radii.

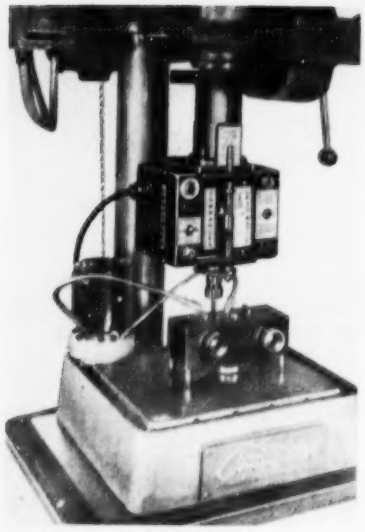
Fixture is designed to regrind the ¾-in. radius on both the right- and left-hand tools to give a true radius for cutting journal bearing surfaces. Accurate contour on an axle-turning operation facilitates burnishing. Built-in adjustments allow for tool wear on length and width. Fits any table of a standard tool and cutter grinder, as well as most units with mechanical in-feed hand wheel. It can be used to grind or dress additional radii within a range of approximately ⅜ to 1⅛ in.

Apex Tool & Cutter Co, Inc, Shelton, Conn

Hyster Lift Truck Attachment

Hyster load grab attachment is now available as a load grab side shift and remote control fork positioner. The attachment can now be aligned with the load instead of requiring close maneuverability. Pallet-type forks are also converted for use as a remote control fork positioner.

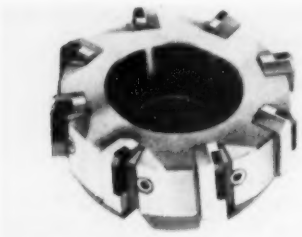
Hyster Co, 2902 N E Clackamas St, Portland 8, Ore



Lead-Matic Tapper Is Electrically Controlled

Electrically controlled, automatic high-production leadscrew tapping attachment has a range of No. 0 to ¾ in. Electrical controls on the face of the unit permit selection of the proper tapping action, jog or cycle. The unit is provided with a precision-ground leadscrew which pilots the tap into the work. It is claimed that perfect thread lead and concentricity are assured because the leadscrew provides both concentricity and tapping lead while the drillpress merely provides rotation. Inaccuracies of the drillpress are not reflected in the performance of the tapper.

Commander Mfg Co, 4225 W Kinzie St, Chicago 24, Ill

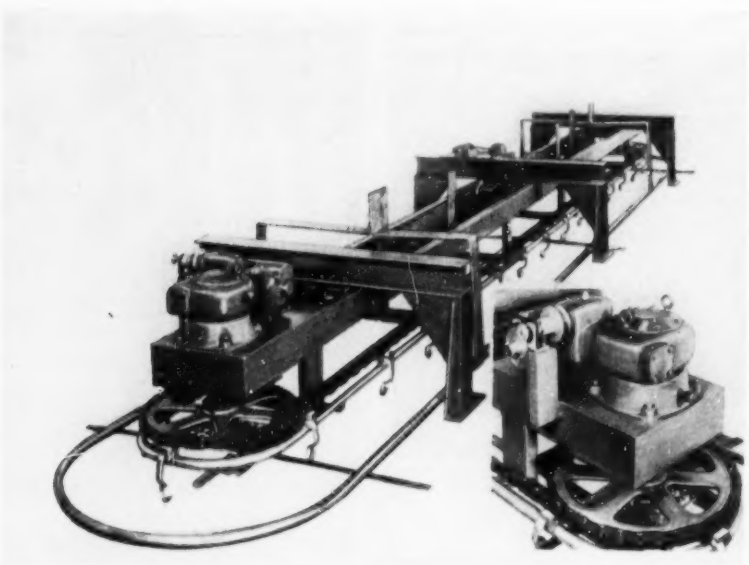


Inserted Blade Shell End Mills

Inserted blade shell end mills for steel, cast iron, and non-ferrous metals have been added to the Super Tool line of carbide cutting tools.

Serrated - back, carbide - tipped blades are secured with minimum stress by wedges which distribute holding pressures along entire length. DBSS cutter for steel is available in 4-, 5-, 6-, and 8-in. diameters; DBS cast iron cutters are stocked in sizes 3 to 8 in. inclusive.

Super Tool Co, 21650 Hoover Rd, Detroit, Mich



PACKAGED SEMI-AUTOMATIC PLATING SYSTEM is designed to replace or augment still tank plating. When run is completed, or between runs of a certain part, system may be altered for a different job by shifting pusher shoes to desired spacing. Spacing to any dimension in 2-in. increments is accomplished by removing pusher shoes. Variable speed control and drive are combined in one unit; V-belts are used for drive and agitating mechanisms; agitation is by longitudinal motion. Unit can be loaded at any point, including ends of tank. Anode bar is formed equidistant from cathode at ends as well as side so that plating is uninterrupted and quality uniform—*Wagner Brothers, Inc, 402 Midland, Detroit, Mich

Finishing Method Improves Life of Carbide Tools

Finishing method perfected by Penn Scientific Products Co is based on using a dual wheel consisting of 120-grit silicon-carbide vitrified-bond grinding wheel for semi-finishing and a phenolic resin diamond-lap insert for fine lap finishing. After rough grinding, tools are finished-ground dry on 120-grit outer section of dual wheel, then moved in to lap insert for finishing.

Pensco wheel lap insert is charged with Spectrum diamond lapping compound of the desired grit size. The diamond lapping operation, completed in a few seconds, reduces the surface finish of the cutting edge of the tool from 150 to 20 rms after finish grinding to 1 to 2 rms after finish lapping.

Reportedly, tests prove that life of tools sharpened by this method is increased from 3 to 8 times over that of a normally finish-ground edge.

The Pensco dual wheel is supplied complete in a convenient kit with a 5-gr tube of Spectrum diamond lapping compound in any one of 12 standard grit sizes. Also included is a 4-oz bottle of diamond lapping oil with atomizer applicator and wheel-charging roller.

Penn Scientific Products Co, 5941 Alma St. Philadelphia 24, Pa

Heavy-Load Lift Truck

Safeway has introduced a new truck made in three sizes with lifting heights of 68, 80 and 100 in., and lifting rating of 1250 lb.

Electronic switch cuts off power at maximum height to prevent jarring load and damage; hand-operated brake prevents movement of truck when loading and unloading.

Safeway Industrial Equipment Corp, 184 North Franklin St. Chicago, Ill.

FYI
FOR YOUR INFORMATION

FREE Catalogs, Booklets, Charts, Calculators

FYI—these initials symbolize information that's important. And there is much of importance in the literature listed here. To get the ones you need, all you do is fill out one coupon for each booklet you wish to order. Indicate in the circle on the coupon the number of one catalog wanted. When you have filled out a card, detach, stamp, and mail. We'll do the rest.

MACHINES AND ATTACHMENTS

1 BORING MACHINES — *Ex-Cell-O Corp, Detroit, Mich.* 16-page illustrated bulletin 31205 provides detailed description and specifications. Unusual applications included.

2 GEAR GRINDING MACHINE — *Sheffield Corp, Dayton, Ohio.* 8-page catalog GG-52 contains illustrated information on Model 140 reciprocating unit for production of precision ground helical and spur gears. Request on company letterhead.

3 NOTCHING UNITS—*Wales Strippit Corp, North Tonawanda, NY.* 20-page catalog N illustrates and describes line for use in unlimited setups in stamping presses and press brakes.

4 MACHINE TOOLS — *Portland Machine Tool Works, Inc, South Portland, Maine.* 24-page booklet illustrates newly-designed machines, including horizontal duplicating miller, 5-axial, 3-dimensional, automatic contour milling machine. Data on machines built to order, adapting, rebuilding, and redesigning of in-use machines included.

5 THREAD MILLING CUTTERS—*Detroit Tap & Tool Co, Base Line, Mich.* 16-page manual D-52 provides complete technical information on speeds and feeds, maintenance, inspection and tolerances. Tables, methods, charts, specifications provided. Request on company letterhead.

6 BORING AND MILLING MACHINES — *DeVlieg Machine Co., Detroit, Mich.* 23-page catalog provides detailed, illustrated data on Spiramatic Jigmil units. Structural features, attachments, applications, and specifications covered.

7 PANTOGRAPH ENGRAVER—*Mico Instrument Co, Cambridge, Mass.* 10-page catalog 53 contains extensive information on duplicating and engraving unit. Components and accessory parts illustrated, and recommendations for classes of work included.

8 PRESS BRAKES — *The Cincinnati Shaper Co, Cincinnati, Ohio.* 72-page catalog B-4 describes complete line. Applications illustrated, selection recommendations outlined, specifications and special equipment included.

9 BROACHING PRACTICE—*National Broach & Machine Co, Detroit, Mich.* 80-page illustrated manual covers all phases of operations. Applications, definition of terms, broachability of materials, fixtures, maintenance, case studies included, as well as chapter on correction of broaching troubles. Request on company letterhead.

10 MACHINE TOOLS AND ACCESSORIES—*Morey Machinery Co, New York, NY.* 180-page catalog illustrates and describes extensive line of domestic and European models, plus extensive section on tools for turret lathes.

TOOLS AND ACCESSORIES

11 TOOLS—*Cornwell Quality Tools Co, Mogadore, Ohio.* 128-page catalog has detailed, illustrated descriptions of standard and specialized tools.

12 REAMERS—*Lavallee & Ide, Chicopee, Mass.* 39-page illustrated catalog 53 contains indexed data on complete line. Specifications and illustrated price list included.

13 TAPS—*Threadwell Tap & Die Co, Greenfield, Mass.* 55-page manual contains indexed information on all phases of operation. Thread systems diagrammed; dimensions, charts and tables included.

14 CARBIDE BLANKS AND TOOLS—*Vascoloy-Ramet Corp, Waukegan, Ill.* 56-page catalog VR-441 illustrates and describes complete line including toolholder inserts and technical information on carbide and its use. Dimensions, angles, applications and ordering information.

15 THREADING TOOLS — *Sheffield Corp, Murchey Div, Dayton, Ohio.* 15-page illustrated catalog 153 provides data and specifications on die heads, taps, chaser accessories and special tools. Request on company letterhead.

16 CARBIDE INVENTORY PLAN — *General Electric Co, Carboloy Dept, Detroit, Mich.* MTI (Minimum Tool Inventory) Plan, in kit form, provides basic

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information designed to reduce single point tool stocks by one-third, without major changes in inventory procedures.

17 HOLE-PUNCHING UNITS—*Wales-Strippit Corp, Tonawanda, NY.* 32-page catalog BL contains extensive illustrated data on latest developments in BL units, including new specified stripping guide on BL-3 and 3½ series. Information on varied setups included.

HEAT-TREATING AND WELDING

18 METAL WELDING — *Arcos Corp, Philadelphia, Pa.* 18-page booklet provides index and guide to bulletins, charts, and articles on methods and practices. Includes application chart with data on 56 electrodes.

19 TORCHES AND CUTTING EQUIPMENT—*Weldit, Inc, Detroit, Mich.* 28-page catalog illustrates complete line.

20 WELDING HEADS — *Scaky Bros, Inc, Chicago, Ill.* Bulletin 307-10 covers rotating upper stitch head, which fits any electric resistance welder, to produce gas-tight seams of overlapping spot welds.

21 SILVER BRAZING PREFORMS—*Lucas - Milhaupt Engineering Co, Cudahy, Wis.* 10-page illustrated bulletin 52-1A includes tabulated data on alloys, preform specifications, typical parts, and ring weight calculating chart.

PLANT-SERVICE EQUIPMENT

22 SUMP CLEANING — *Spencer Turbine Co, Hartford, Conn.* 4-page illustrated bulletin 130-C describes vacuum equipment to pick up liquids at 40 gal. per minute with tank capacity of 125 gal. Improved equipment for picking up liquid from floors, ducts, etc, also included.

23 FILTRATION EQUIPMENT — *US Hoffman Machinery Corp, Industrial Filtration Div, Syracuse, NY.* Case studies available on applications. Illustrations and diagrams included.

24 WRAPPING—*Angier Corp, Framingham, Mass.* 4-page folder describes Glass-Wrap, a reinforced, water-proof, tear-resistant fabric. Applications and suggested uses illustrated.

25 MATERIALS HANDLING CONVEYORS—*Honan-Crane Corp, Lebanon, Ind.* 20-page catalog 803 describes and illustrates all types of Houdaille conveyors. Capacity charts, layout suggestions, installation and operating instructions, and case history briefs included.

26 HEATERS—*Westinghouse Sturtevant Div, Hyde Park, Boston, Mass.* 32-page catalog 1510 contains extensive information on standard and heavy-duty centrifugal fan heaters. Applications, specifications, performance graphs, accessories and installation instructions covered.

27 FORK TRUCKS — *Lewis-Shepard, Watertown, Mass.* 8-page booklet contains informative operating information. Training program for operators, and preventive maintenance outlined.

28 PLASTIC COATING—*Fidelity Chemical Products Corp, Newark, NJ.* 4-page circular on Dip-Pak 637 hot-melt permanent coating. Protective applications illustrated, and tank specifications included.

29 BELTING—*B F Goodrich Co, Akron, Ohio* 32-page illustrated manual contains detailed data on conveyor and elevator belting. Selection, installation, and maintenance problems covered, as well as applications and tables.

PARTS AND MATERIALS

30 INDUSTRIAL CONTROLS—*Minneapolis-Honeywell Regulator Co, Philadelphia, Pa.* 80-page catalog 8305 covers non-indicating electric, electronic, and pneumatic controllers for temperature, pressure, and humidity; also pneumatic and electric valves, switches, and relays.

31 ALUMINUM SHEET AND PLATE —*Kaiser Aluminum & Chemical Sales, Oakland, Calif.* 152-page handbook includes data on properties, applications, fabrication and finishing. Technical information tables included.

32 RIVETS—*Hi-Shear Rivet Tool Co, Los Angeles, Calif.* Third edition of 59-page illustrated booklet contains complete information. Revised sections on installation and removal data, inspection and riveting hints included.

33 HYDRAULIC OIL CYLINDERS — *Vickers Inc, Detroit, Mich.* 31-page bulletin 52-55 contains engineering data and specifications on complete line.

34 ELECTRICAL INSULATION — *Johns-Manville, New York, NY.* 32-page booklet "Quinterra-Quinorgo" provides extensive data on asbestos insulation. Test data tables on properties, methods and application techniques covered.

35 METAL ABRASIVES, PIGMENTS, POWDERS — *Metal Disintegrating Co, Elisabeth, NJ.* 250-page book, "MD Blue Book" presents extensive data. Shot and grit applications illustrated; powder metallurgy covered in detail; section on technical bulletins available included. Request on company letterhead.

36 VALVES — *Republic Manufacturing Co, Cleveland, Ohio.* 44-page catalog 352A covers needle, globe, plug, check, relief, and special valves. Data on gage protectors and snubber, bleeders and AN vacuum control valves included.

37 FIXTURE CLAMPS — *West Point Mfg Co, Detroit, Mich.* 64-page catalog describes 15 styles of clamps, full scale templet sheets, in 100 sizes and 350 fixture components.

38 BEARINGS — *New Hampshire Ball Bearings, Inc, Peterborough, NH.* 28-page catalog 53 provides dimensional and design data on 137 Micro ball bearings. Loads, speeds, mounting, lubrication, tolerances, gaging and handling of instrument bearings discussed.

39 FASTENERS — *Elastic Stop Nut Corp of America, Union, NJ.* 32-page booklet illustrates case histories of design problems solved with self-locking units.

40 DIAL GAGES — *Boice Mfg Co, Staatsburg, NY.* 8-page illustrated bulletin 53 covers line of bore gages with specifications. Set Master instrument for checking described.

41 MOTOR & GENERATOR REFERENCE BOOK—*Allis-Chalmers Mfg Co, Milwaukee, Wis.* 50-page pamphlet 51R7933 provides extensive illustrated data to assist in selection of motive power.

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OUTSTANDING FEATURES:

A precision machine for drilling, boring, recessing, and milling work. Table can be rotated to 360 degrees. Accurate automatic locking of rotary table every 15 degrees, and at any other position by hand. Table and-spindlehead have variable hydraulic feed. All coordinate dimensions can be set by dials, and adjustment made through optical microscopes. Mechanical spindle feed can be changed without stopping machine. Automatic stop of spindle feed. Optical measuring system operates in conjunction with vernier scales. Vertical movement of column motor operated.

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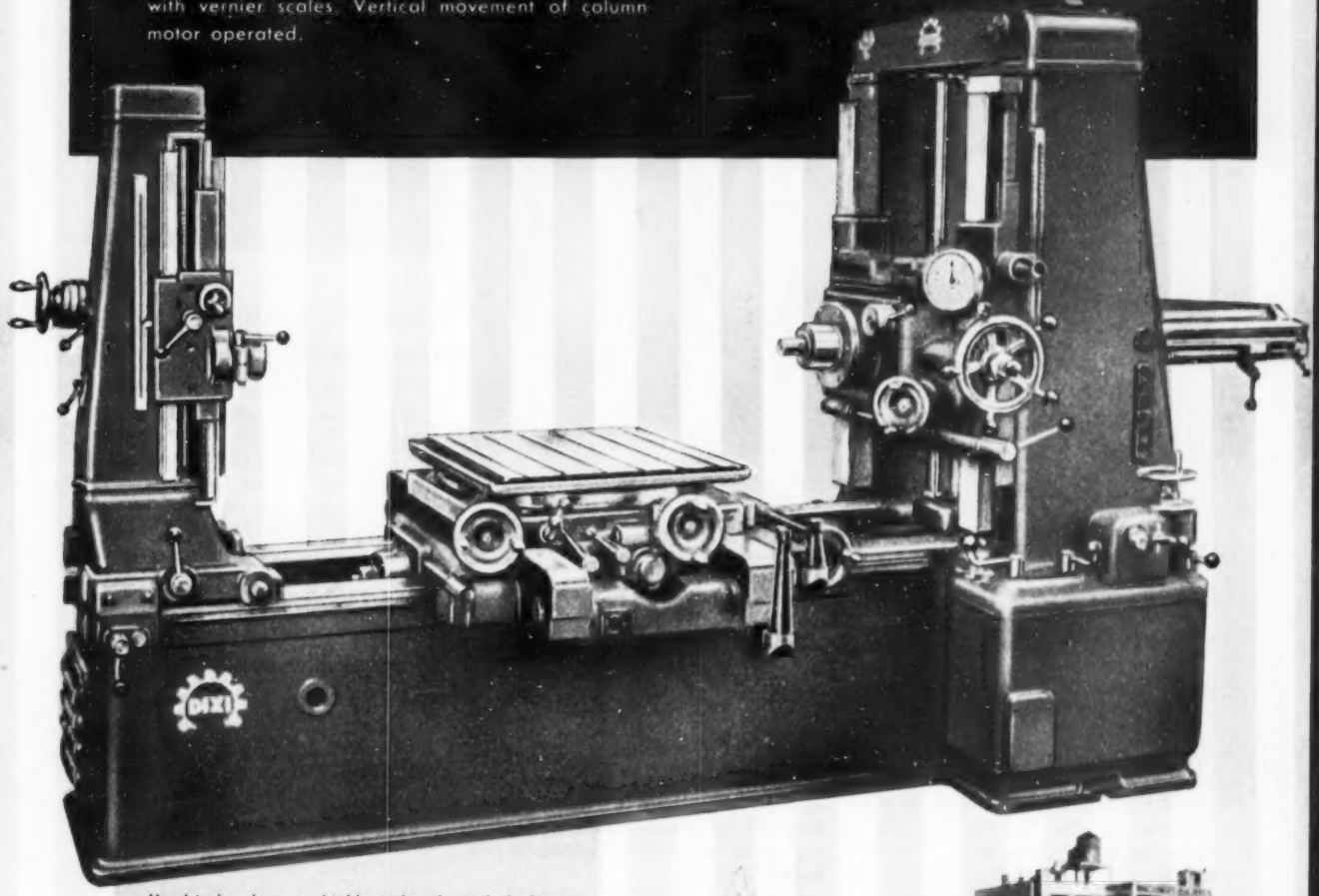

Headstock, column, and table settings by optical microscopes to insure overall accuracy of .0002". Built in rotary table with optical microscope. Tables size 28¾" x 32⅝". Max. distance table to spindle 19.7". Table travel, 23⅝". Hydraulic feeds for all functions 0-78" per min. #40 Taper spindle. Spindle travel 24.4". Spindle speeds 32-1350 R.P.M. Feeds .0015"-.010" per rev.

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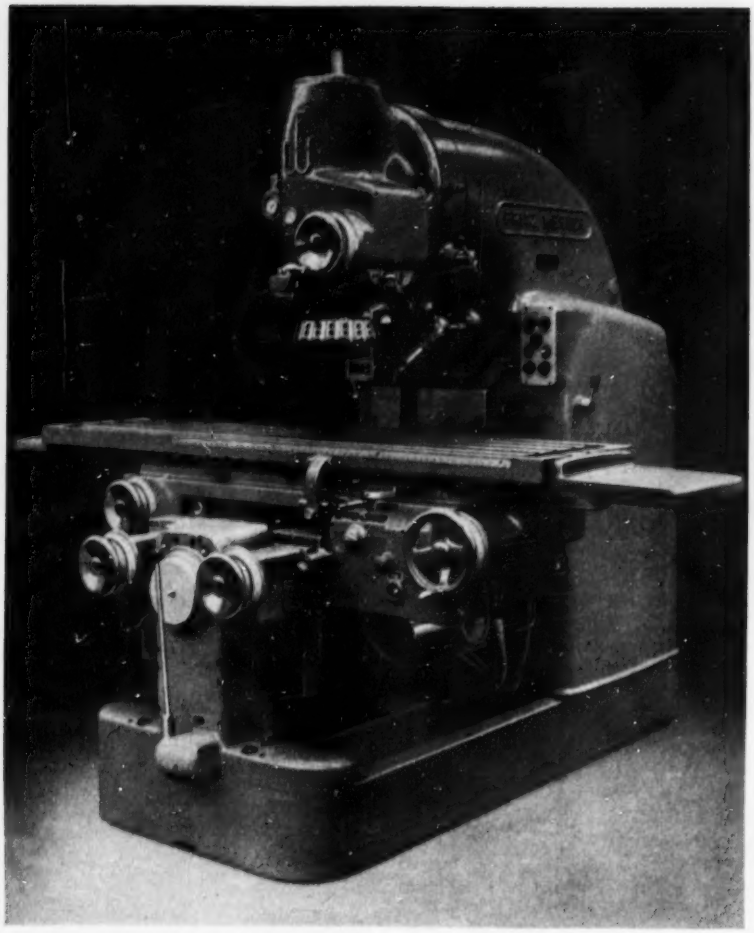

German Milling Machine Has 42 Speeds and 50 Feeds

Werner No. 5 and No. 6 knee-type milling machines are said to be equally suited for toolroom or production use. The No. 5 miller has a table 90x19½ in.; No. 6 table is 110-x19½ in. A plain milling machine of similar dimensions and features is also available.

Preselectors for feeds and speeds allow pushbutton selection of any of 42 speeds and 50 feeds. Speeds range from 16 to 1800 rpm and feeds from 3/16 to 80 ipm. Speed changes are accomplished by solenoid valves which operate hydraulic cylinders to shift the gear clusters. Limit switches are so arranged that the spindle cannot be restarted until the preselected speed has been correctly engaged. During the shifting operation the gears are revolved slowly by an auxiliary motor to insure accurate and smooth engagement of the hardened and ground gears. Feed changes are accomplished by electromagnetic clutches. A total of 11 clutches selects 50 feeds in groups of four. A new feed can be selected and engaged at any time while the machine is cutting.

Other features of the machine are the automatic rise-and-fall device, automatic table clamping and unclamping, permanent visual indication of the feeds, speeds, and directions of traverse set into the machine, automatic spindle lubrication, and the built-in climb milling device.

At the end of the feed stroke the table with automatically fall 2 in; at the end of rapid return the table will rise back to the working position. For single plate work, the rise and fall and rapid traverse can either be controlled manually or switched off entirely.

All three motions of the table are clamped automatically by electro-hydraulic clamps. As soon as a feed is engaged the clamp in that direction is released.

The machines are built on the unit construction principle for ease of maintenance. Electrical and hydraulic equipment is entirely enclosed within the column of the machine. Emergency switches, overload, and no-voltage protection is furnished. All motors are enclosed and built for use in the US on 220/440-v, 3-phase, 60-c power. Power is 40 hp, but a 50 hp motor can be furnished as optional equipment.

Imported by: Marac Machinery Corp, 1819 Broadway, NY 23, NY

Aluminum Pipe Wrench Has Removable Jaw Inserts

Ampco aluminum alloy pipe wrench is said to have tensile strength comparable to steel tools. Weight ranges from 15 oz for the 10-in. size to 128 oz for the 36-in. size. Beryllium-copper jaw inserts are replaceable. Jaw inserts made of steel can be supplied.

Ampco Metal, Inc, 1745 S 38th St, Milwaukee 46, Wis

Rubber-Cushioned Abrasives

Weldon Roberts has announced the addition of a series of rubber-cushioned abrasives to its Brightboy line. The Brightboy BL series is available in three grades: 54BL, coarse; 70BL, medium; 120BL, fine. There are a variety of sizes in wheels, disks, sticks, reds, cylinders, tablets, and blocks for machine and manual use. It is said they work to close tolerances and can be shaped to contour.

The series features a rubber binder, compounded with abrasive grain, to achieve a tough rubber cushion. The new textures are reportedly particularly successful in removing heavy tool marks from forged aluminum, smoothing weld marks, and polishing and burring stainless steel. The abrasive works on all metals and will do many jobs on glass, wood, plastics, and laminated materials.

Brightboy Industrial Div, Weldon Roberts Rubber Co, Sixth Ave and North 13th St, Newark 7, NJ

Moen Single-Handle Faucet, made by Moen Valve Co., Division of Ravenna Metal Products Co., Seattle 5, Washington.

Sketch showing operation of Moen Faucet, which can be operated by one hand, giving water at the desired temperature at any rate of flow. You can change volume without changing temperature, or change temperature without changing volume, or select the desired temperature before turning on the water. Available in various styles and types.

Faucet maker finds **unit cost more important** than cost per pound

This Moen Faucet is unusual. First, its design represents a new idea in faucets so far as we know. If we are wrong, we will welcome the correction. But in any event, this modern faucet is selling like mad; people really want its convenience, its simple operation, its one-hand control. The second unusual thing about the faucet is that the spout is made of Admiralty Metal, supplied by Revere. This metal was chosen by Moen after consultation with the Revere Technical Advisory Service, which pointed out the qualities of Admiralty from the standpoints of bendability, and plating characteristics. Everything considered, the "more expensive" Admiralty turned out to be less expensive in the end, and more satisfactory both to the Moen Valve Co. and to its customers. The faucet also uses Revere Free-Cutting Brass Rod for interior machined parts, this again being chosen for workability and corrosion resistance. Service to Moen and to many other industries in the Mountain State area is of course provided by the Revere sales, technical and mill personnel on the Pacific Coast. Similar services are of course available from Revere everywhere in this great country. To obtain the Revere services, see the nearest sales office.

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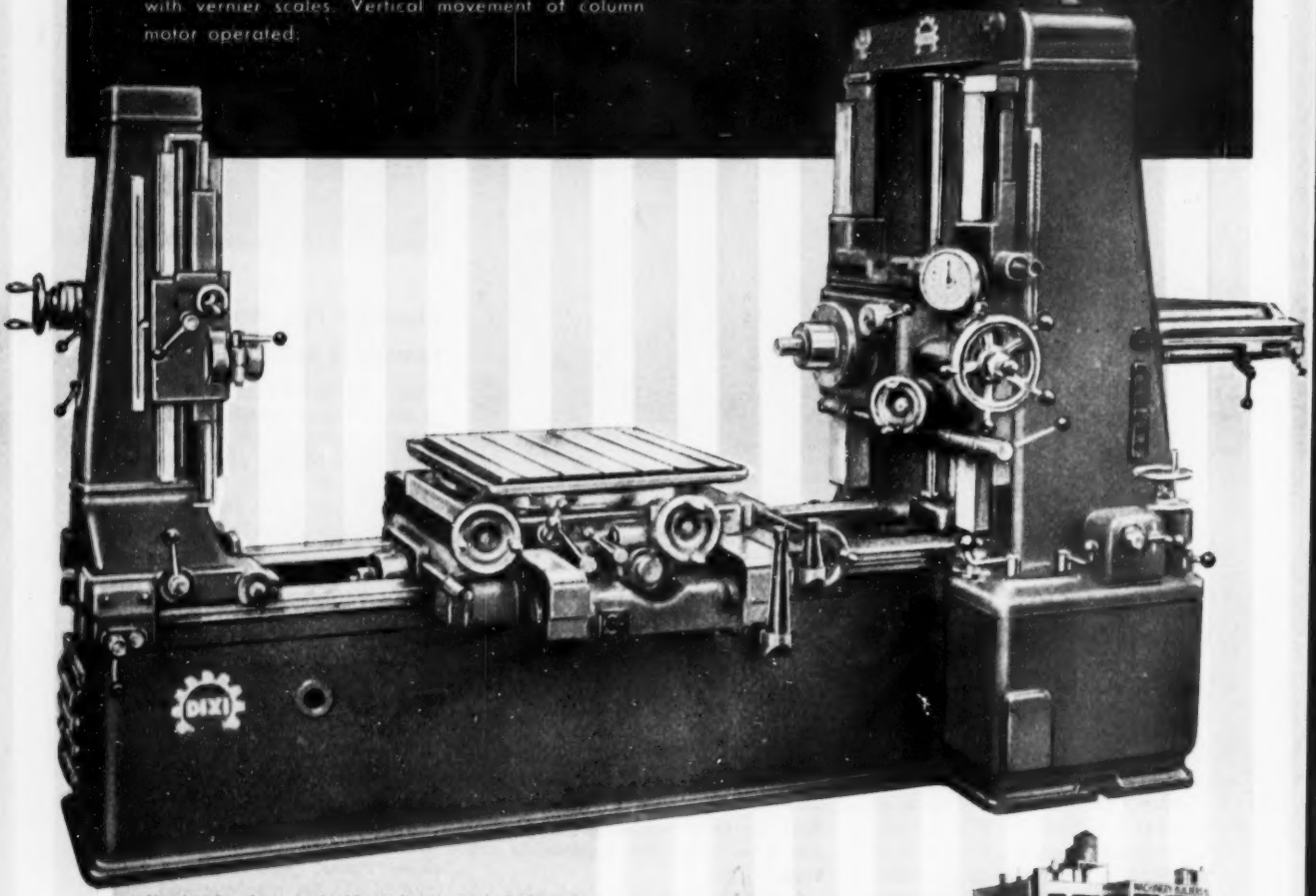

Headstock, column, and table settings by optical microscopes to insure overall accuracy of .0002". Built in rotary table with optical microscope. Tables size 28¾" x 32⅝". Max. distance table to spindle 19.7". Table travel, 23⅝". Hydraulic feeds for all functions 0-78" per min. #40 Taper spindle. Spindle travel 24.4". Spindle speeds 32-1350 R.P.M. Feeds .0015"-.010" per rev.

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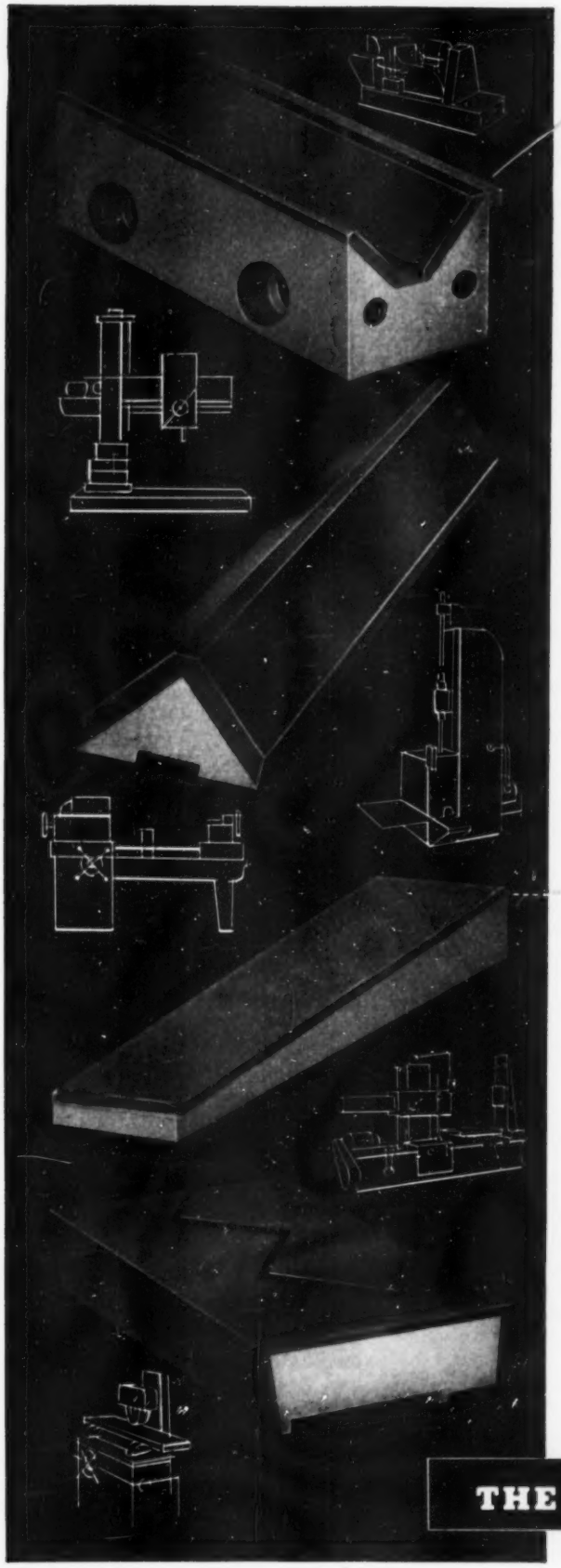

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OK wear strips are now available in welded Ampco bronze. Because of the OK's special bi-metal method of welding, less bronze is required. These ways are ground to close tolerances thus reducing manufacturing and assembly time.

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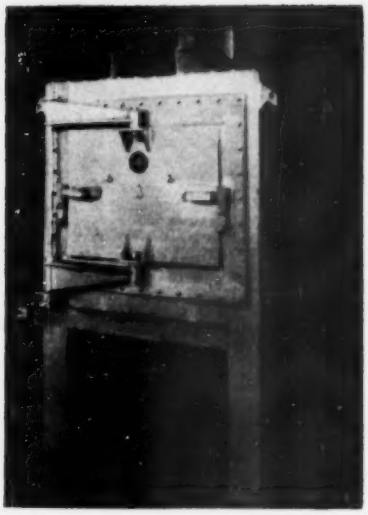
Hydraulic Knife Grinder Head Tilts From the Vertical

Cleveland hydraulic knife grinder is designed to grind straight and concave bevels of any desired angle or straight flat surfaces within the capacity of the machine. The wheel head is arranged to tilt from the vertical position and thus the plane of the grinding wheel is at an angle to the work being bevelled as the outside rim of the grinding segments is brought into contact with the knife being ground.

Hydraulic crossfeed is provided for the wheel head at instantly variable speeds as the 18-in.-dia segmental grinding wheel travels across the work horizontally. This hydraulic crossfeed permits the grinding wheel to feed into and across the work without actually moving the head down, and as soon as the work comes in line with the center of the vertical spindle, the hydraulic crossfeed stops. Then, through the use of hydraulic rapid traverse the wheel head is returned to the original position and manually fed down to a predetermined feed by the operator.

Table speeds are variable up to 100 fpm; hydraulic pump of 30-gal. capacity supplies oil to two opposing pistons. Cross travel speeds vary up to 10 ipm; max length of stroke is 10 in. Spindle motor is 20 hp.

The Hill Acme Co, 1201 W 65th St, Cleveland 2, Ohio



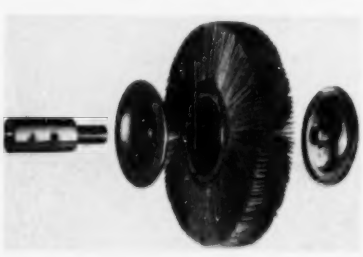
Box Draw Furnace Operates to 1400 F

Westinghouse electric box draw tempering furnace was designed for applications requiring no protective atmosphere. This type DB furnace is used for batch drawing or tempering high volume work that can be handled on trays.

Maximum operating temperature of the furnace is 1400 F and an automatic temperature control accurately regulates any heat set within this range. High-velocity centrifugal fan provides uniform air circulation over the heating elements and around the charge chamber.

Furnace is available in six sizes ranging from 15x24x12 in. to 42x72x30 in. The five larger sizes use 480 v; the smallest, 240 v.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa



Flexible Grinding Wheel Made Of Cloth Leaves

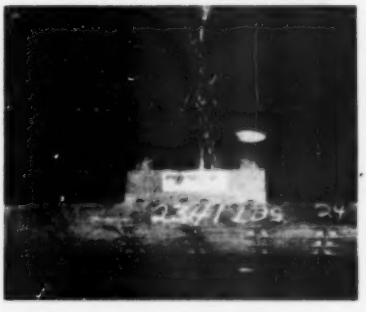
Grind-O-Flex is a flexible grinding wheel which consists of hundreds of individual abrasive cloth leaves sealed to a hard core. As the wheel rotates it presents a continuous abrasive surface to metal parts. It is designed to smooth surfaces and remove flaws from contours without the danger of digging into the stock. Wheel is 6½ in. in dia, 1 in. wide, and available in a variety of grits.

Grind-O-Flex is said to be simple to set-up and operate. A mounting arbor is provided for attaching the wheel to any standard plain or threaded shaft or for chucking ½- or ¼-in. chucks.

Flanges, which are held in place by one nut, are also provided. Arbor and flange may be used repeatedly, the wheel being replaced when worn.

Unit weighs 8 oz and a 1/6 hp motor is usually sufficient.

Merit Products Inc, 4023 Irving City, Culver City, Calif



LIFTING MAGNET, with 5000-lb capacity, is one of new line being produced by O S Walker. Walker lifting magnets employ complete saturation and equable flux distribution. Square design means maximum contact area. Price of magnet shown: $440.00 — *O S Walker Co, Inc, Worcester 6, Mass*

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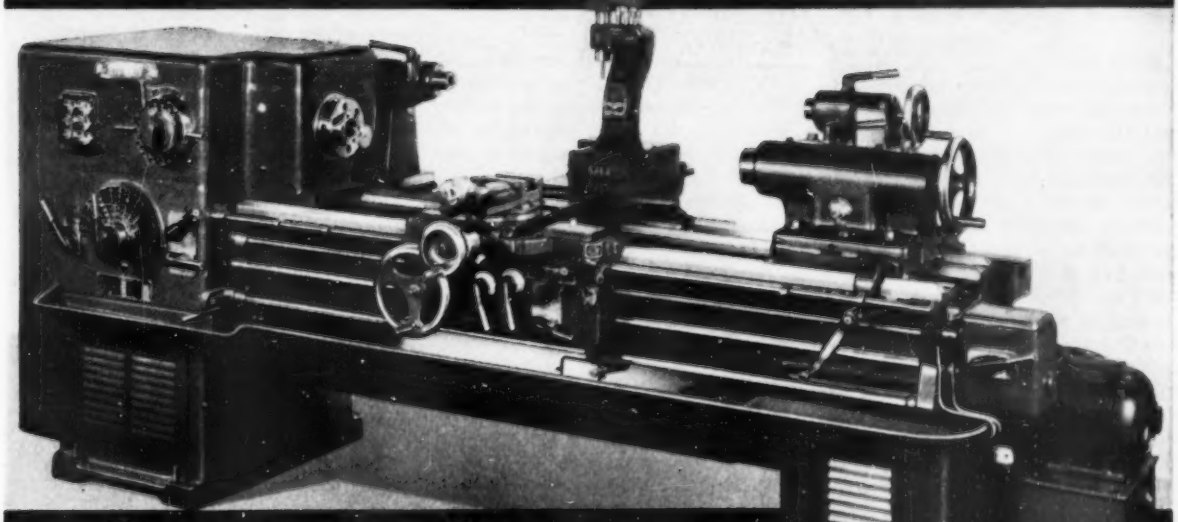
FOR INCREASED PRODUCTION AND LOWER COSTS

WHY? — *Because here are the points of superiority of*

SIDNEY HEAVY-DUTY LATHES

1 Change gears rotate on anti-friction bearings and are mounted on fixed centers. Driving sheave is mounted on pre-loaded anti-friction bearings and is full floating on sleeve bolted to back of headstock, which eliminates drive shaft deflection.

2 All-herringbone geared headstock provides 32 pre-selective changes of spindle speeds through convenient dial control. Spindle and intermediate shafts are equipped with center bearings in addition to end bearings. Spindle mounting automatically compensates for expansion caused by temperature rise.



3 Sidney's totally enclosed dial controlled gear box provides 60 changes of threads and feeds. All moving parts run constantly in oil.

4 Controls are conveniently located for comfortable operation. Off-set compound—extra large micrometer dials—thumb screw dial lock. Notice also the four swivel hold-down bolts for added rigidity.

5 Rigid four-wall bed construction with double cross girts spaced at 12" intervals. Casting is of semi-steel nickel mixture for close grain structure.

WRITE FOR BULLETINS

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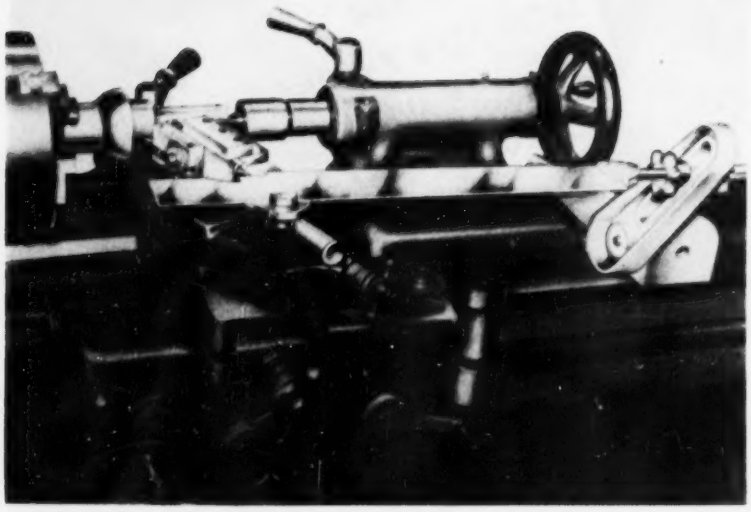


Lehigh Profile-Tracing Attachment For 9- through 13-in. Lathes

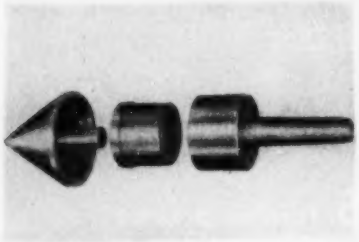
Lehigh Pro-Tracer, Model EL-1100, is easily installed and adaptable to many different applications. Boring and ID contours can be turned by the same method as conventional OD turning and a 90 deg step can be cut in the direction of feed. Reportedly the unit can be used effectively for all types of OD turning, including tapers, and will make a 0.031-in. minimum radius. Profile tracing is accomplished by turning Pro-Tracer at right angles to the spindle. Internal or external threadings, straight or tapered, can be made and it is said that because of the quick cutting-tool retraction, the thread can be cut close to a shoulder without danger of tool-breakage.

Installation requires no alteration to the lathe. The toolpost is removed and a single bolt fastens the unit to the compound so that it can be adjusted to any cutting angle. A second bolt secures the fully adjustable templet-holding bracket to the lathe bed. Full use of both crossfeed and compound is permitted at all times.

Accurately ground ⅛x2-in. wide gage stock templets are recommended to guide the movement of the Pro-Tracer slide. Templet length is limited only by the length of the lathe. Preloaded ball bearings in the slide assembly prevent play.

Cost of the unit is $375.

Lehigh Foundries, Inc, Air Control Div, 1500 Lehigh Drive, Easton, Pa



Live Center Speeds Old Lathes up to 300%

Live center incorporating the features of the Jergens pilot bearing bushing can restyle and make old lathes efficient and productive as newer units, according to the manufacturer. It is said that on a typical installation with Babbit spindle bearings, depth of cut was increased 300% with cutting speed increased 55%. New tool is said to allow use of carbide tools in older equipment, and withstands heavy thrust loads while maintaining extreme precision.

Live center with a No. 4 Morse taper shank and 4-in. ID capacity nose (illustrated) can be furnished in any type; it is adaptable to metal spinning lathes, grinders, turret and automatic lathes, and hobbing machines.

J G Jergens Co, 11106 Avon Ave, Cleveland, Ohio

Nord Power Nibbler Has Detachable Crank Case

Power nibbler Model G also beads, folds, cuts straight or circular lines, slots, and louvers, irregularly or freehand with accessories furnished with the machine.

Nibbler mechanism operates in an enclosed oil bath. Detachable crank case is designed to permit construction of special frames for specific purposes at reasonable cost. Reassembly of the case to any special type of frame is easily accomplished with standard tools.

Tool changing is said to be exceptionally easy; lower toolholder has the same center line as the upper, and a handwheel makes a fine adjustment to any desired setting. Shift from circular cutting to straight can be made without removing lower slide block; only the upper slide needs to be released and removed by sliding to the rear.

Range of materials that can be cut are 3/32-in. continuous cutting of cold rolled steel (⅛-in. short cuts); 5/64-in. stainless, and 5/32-in. brass or copper. Circle cutting ranges between 2-23/64-in. and 28½-in. dia. Folds to 5/64 in., and beading to 3/32-in. plate thicknesses are readily accomplished.

Over-all dimensions are 50 in. long by 31½ high by 13 wide with throat depth of 28-17/32 in. A 0.65-hp electric motor is mounted behind the crank case enclosed drive.

Nord International Corp, PO Box 44N5, Denville, NJ

MISPLACED CIPHERS

In two recent items in this department there was, we regret to say, difficulty with misplaced ciphers. In describing the 25-kw r-f generator built by Westinghouse Electric Corp, there was an extra cipher. Filament voltage is controlled to 3% to prolong tube life, not 30% as reported.

In the other case, a cipher was missing. The Multi-Stop built by Claremont Instrument Co is reported to be accurate to 0.0005 in., not 0.005 in.

YOU'LL WELD MORE AT LOWEST COST with

A.O.Smith CHALLENGER

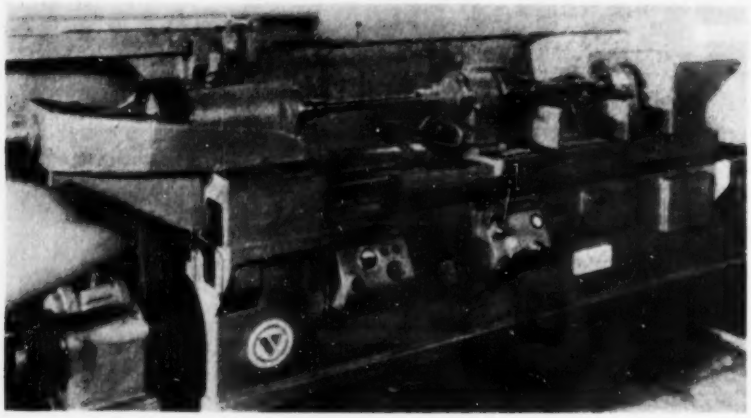
200-, 300- OR 400-AMP. A.C. WELDER

- **Greatest amperage** range in its price class. Example: the 400-amp. model has 510-amp. welding range.
- **75-volt** open circuit: easier-striking, smoother arc; welds *all* electrode types.
- **Needs no boosters,** starters or short-lived gadgets. Easy, low-cost maintenance.
- **Performance-proved** on 24-hour production welding assignments.
- **Costs less** to buy, own and operate.

For complete data on this high-performance, industrial welder, and on the complete A. O. Smith machine, electrode and accessory line, see your A. O. Smith distributor or write A. O. Smith Corp., Welding Products Division, Dept. AM-653, Milwaukee 1, Wis. *International Division: Milwaukee 1, Wis.*

MADE BY WELDERS . . . FOR WELDERS

A.O.Smith
CORPORATION



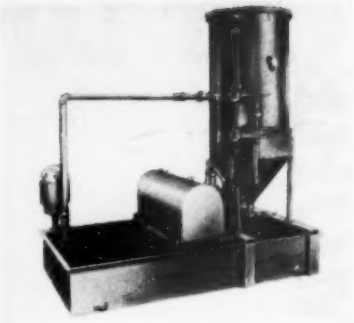
Machine For Boring and Internal Profiling Engine Parts

Alfing model HF machine for boring and internal profiling engine parts has been introduced by Morey Machinery. Shafts which must be profile bored are first rough drilled and rough turned. A sizing bar is placed in the shaft concentric with the OD and the space is filled with a matrix material which hardens in 10 sec. The special machine used for this can serve a number of internal profiling machines.

The shaft is placed in the machine and the boring bar replaces the sizing bar in the matrix. The matrix serves as a continuous bearing for the boring bar until it is cut away, with the chips, as the hole is profiled. The tool is hydraulically controlled to follow the profile of a templet mounted on the machine.

This method permits the design of jet engine shafts and rocket tubes of any length and internal profile.

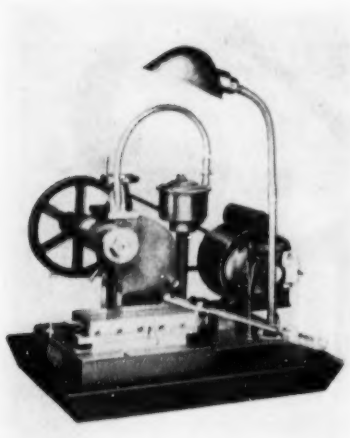
Morey Machinery Co, Inc, 410 Broome St, NY 13, NY



Houdaille Coolant Clarifier Uses Self-Cleaning Tubes

Greater filtering capacity plus low operating cost is claimed for the J-type coolant clarifier by the Honan-Crane Corp. The multiple-tube filtering unit has over 16,000 sq in. of filtering area to remove chips, abrasives, dirt, and other solid contaminants from both water-based and mineral oil coolants. The self-cleaning tubes are suspended vertically within the clarifier and washed free during the backwash period. Several models with different capacities are available.

Honan-Crane Corp, 701 Indianapolis Ave, Lebanon, Ind



Bench Mill Performs Variety of Operations

Bench model mill, adaptable to a wide range of light operations has been especially designed to do precision work and reduce production costs on jobs often assigned to larger mills.

Unit can be used for making key ways, slotting, splitting, squaring at different angles, small screw slotting, and similar jobs.

Interchangeable pulleys permit a wide range of speeds up to 7000 rpm. Heavy-duty spindle mounted on ball bearings assures accurate, noiseless operation. Spindle is designed with a 13/32-in. through-hole and No. 7 Brown & Sharpe taper for mounting arbors, shanks, and adapters. Pulleys are accurately balanced and closely inspected to prevent vibration and chatter.

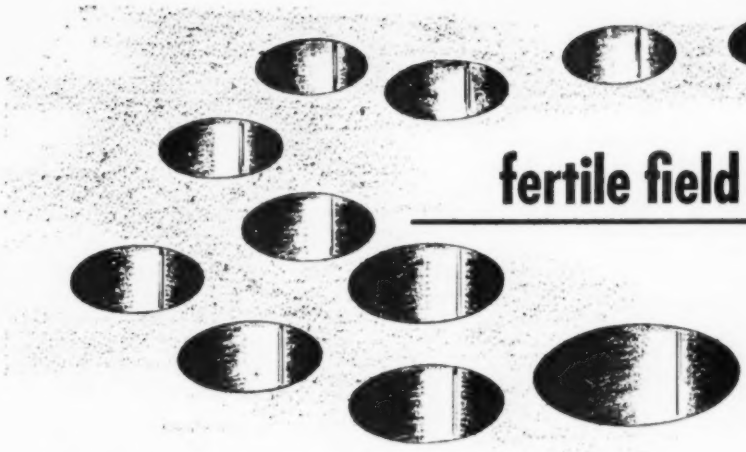
Precision setup block, measuring 3½x9x¾ in. high is machined with key-ways on top and bottom at right angles. Single-slide table with large dovetail ways and adjustable gibs permits 4-in. travel with plastic handle lever, and stop at both ends to limit travel. A ½-in. or 1-in. arbor and drawbar are used for end mill holders and arbors. Base dimensions of the portable unit are 11x18 in. Powered with a 1/3-hp, single-phase motor, the mill operates on standard 110-v, 60-cycle ac.

Viking Industries, Rockford, Ill

Automatic Pick-Up Tweezer

Automatic pick-up tweezer was designed for oddly shaped items, hot pieces, and sterile objects. Depressing the top plunger causes three hooked, spring steel fingers to extend and flare out. Releasing the plunger causes them to withdraw toward the tip and close together. The fingers extend to 1¼ in. between tips. Unit is made of stainless steel.

Win Sales Co. Dept 16-F, PO Box 257, Forest Hills, NY

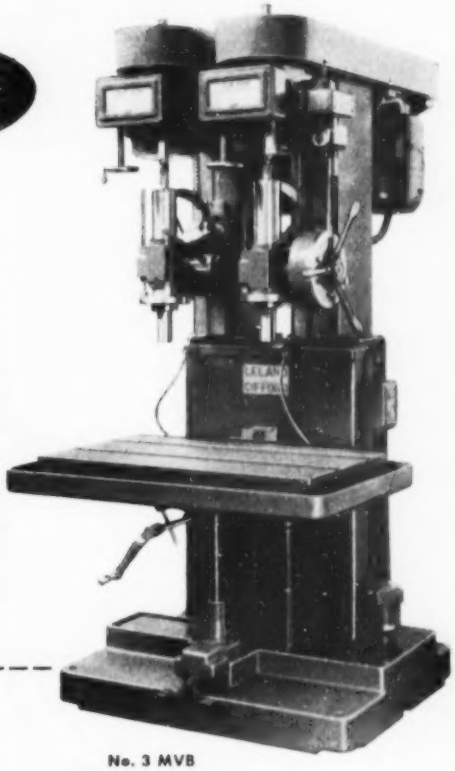


fertile field for cost cutting....

Think of all the HOLES you drill per year

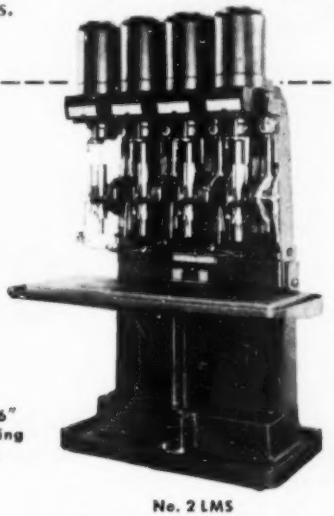
If you want to save money, start where the chances are best . . . *with your drilling operations!* Even a slight reduction per hole adds up fast when you think of the holes you drill per year. But these new Leland-Gifford drilling machines will give you much more than a "slight" reduction. They're miles ahead of anything built twenty, ten or even five years ago.

Fast, powerful, rugged yet sensitive, each is capable of handling a wide range of work. All have new features that make for easier operation, faster work handling, greater accuracy and quicker adaptability to changing production requirements.



No. 3 MVB
Holes from ¼" to 1½"
24" Swing 1 to 4 Spindles

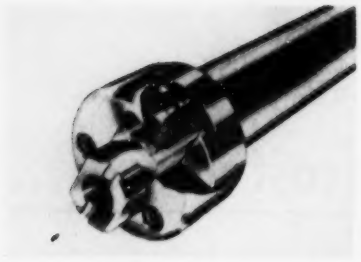
No. 1 LMS
Holes from
No. 80 to 5/16"
12" or 20" Swing
1 to 6 Spindles



No. 2 LMS
Holes from 1/16" to ¾" 20"
or 26" Swing 1 to 6 Spindles

If you drill precision holes, you can't make a more profitable investment than new Leland-Gifford Drilling Machines. Write for complete information.

LELAND-GIFFORD
Drilling Machines
WORCESTER 1, MASSACHUSETTS, U.S.A.



Offset Boring Chuck Has Positive Centering

Samson heavy-duty offset boring chuck has positive centering for drilling and milling which eliminates necessity of chuck removal. Extra-large dial with micrometer screw makes precision adjustment of offset possible and accurate resetting for duplicating and operation. One-piece body and shank enable the chuck to support the tooling as rigidly as the machine itself in heavy-duty operations.

Unit is available with any shank or adapter for holding boring bars, drills, end mills, and similar tools. Complete set of interchangeable accessories, designed with a key drive, are heat treated and ground to a 0.0005-in. slip-fit in the tool block.

Last Word Sales Co, 18500 Mt Elliot, Detroit, Mich

Torit Acetylene Outfit for Varied Work Requiring Heat

Acetylene torch set, designed for any light heating, brazing, or soldering operation, uses only acetylene gas from a Presto B tank, yet develops a temperature of 2800 F. The few pounds of pressure required to operate the torch is handled by a regulator and gage combined with the tank connection.

Four tips, an adapter unit, and a soldering copper are supplied with each outfit. One of the short tips gives a standard flame, the other a large brush flame. Soldering copper reaches proper heat almost instantly and retains it until it is turned off.

Use of pressure regulator and welding hose minimizes any chance of breaks or popped hose connections, even when turned off at the torch handle. Adapter tip eliminates possibility of fumes striking back against the air suction holes.

Torit Manufacturing Co, 280 Walnut St, St Paul, Minn

Versatile Automatic Grinder

Type A dual-head Rotamatic grinder introduced by Standard Electrical Tool Co is claimed to be unusually versatile. Predetermined angular movement or graduated swivel mounting for optional movement, with special workholders, ASSN spindle nose and rotary magnetic chucks permit application to a wide variety of work.

Each of the two grinder heads is operated by hydraulically controlled air cylinder. Machine is also available with hydraulic operation.

There is easy access to all equipment inside the base, consisting of belted motor-drive with mechanical brake, solenoids, valves, motor-driven coolant pump with reservoir, and—when required—with accessories for magnetic chuck, including brush ring and rectifier. Removable wheel dresser located on the workholder, with air-powered ram, permits dressing wheels simultaneously. Lateral micrometer adjustment on each grinder head compensates for wheel wear and dressing.

The Standard Electrical Tool Co, 2480 W Sixth St, Cincinnati, Ohio

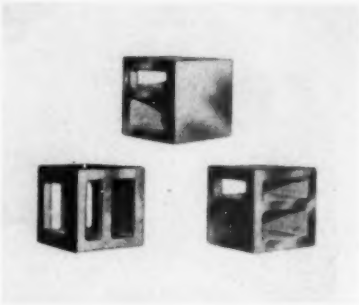
Impact Power Drive

Dril-O-Driver converts all electric drills into impact screwdrivers to drive screws or bolts.

Fifty-four ¼-in.-drive standard tool accessories are on the market for use with an electric drill and driver unit equipped with special adapter. Wrench manufacturers offer these ¼-in. drive sockets to process hex and square nuts, Phillips, Clutch, Allen, Reed & Prince, wood and metal screws. Cone construction permits operator to control force and speed of the driver from 0 to full speed of the drill.

Priced at $9.95, including adapter and screwdriver bit.

Drilo Corp, 201 East Carson St, Pittsburgh, Pa



Box Angle Incorporates Variety of Features

Universal box angle has been designed to incorporate the clamping facilities of an angle iron, the stability, balance and accuracy of a box parallel, and the perpendicular flat surface of an angle plate.

Angles are made of high grade semi-steel, heat-treated with precision ground finish. They are available in two sizes, 6x6x6 and 8x8x8 in.; additional sizes can be made to order.

Challenge Machinery Co, Grand Haven, Mich

This joint must carry water at 500°F and 1600 p.s.i.

RADIOGRAPHY says the weld's sound

To gain top efficiency, modern power plants are operating at higher pressures and higher temperatures—conditions which call for utmost dependability in the welded joints of the piping.

Here radiography is invaluable; it alone can prove the soundness of the welds.

In this way radiography has opened new fields to welders. In high pressure piping, in the manufacture of pressure vessels, and in other applications where welding was once banned, it is now an accepted procedure.

Radiography can help you build business as well as earn a reputation for highly satisfactory work.

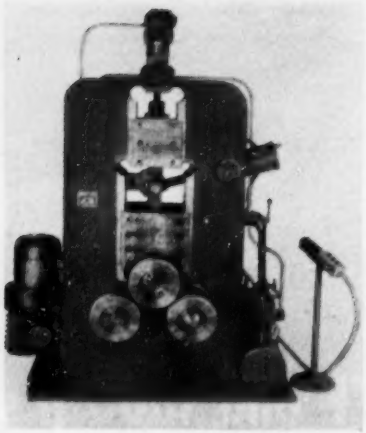
If you would like to know more about what it can do for you, talk it over with your x-ray dealer.

EASTMAN KODAK COMPANY
X-ray Division, Rochester 4, N. Y.

Radiography . . .

another important function of photography

Kodak
TRADE MARK



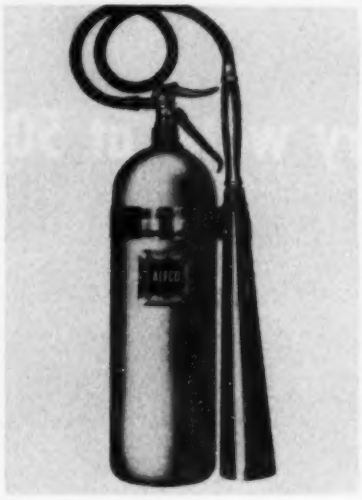
Wallace Rolling Machine

Wallace 490 Series rolling machine is constructed of rolled steel plates and sections, electrically arc-welded with all welds stress relieved. Pushbutton controls are mounted on a pedestal stand connected to the machine with a flexible steel cable. Capacities: pipe or conduit IPS 1¼ to 3½ in.; steel tubing 1¾- to 4-in. OD.

Machine possesses a fast-action, repeat-positioning roll adjustment. When the initial setting of the bending roll is completed, the re-indexing is accurately controlled by the hydraulically actuated toggle mechanism. Having once set the bending roll to produce a given radius, the roll may be raised and lowered by hydraulic power without disturbing the initial setting.

A pitch roll attachment is placed on the fixed drive roll to provide an easy means to obtain the pitch desired in a coil. The initial bend may be started anywhere along the length of the material. Where threaded end tangents are required, the pipe or tube may be threaded on each end prior to rolling. Short radius bends can be made in rigid material in one pass through the rolls. A limit switch is provided to control the height to which the bending roll can be raised. An electric motor is mounted on top of the roll bender to run the vertical screw used in raising or lowering the bending roll.

Wallace Supplies Mfg Co, 1300 Diversey Pkwy, Chicago 14, Ill



Alfco Fire Extinguisher

Alfco extinguishers have been redesigned to include a simplified, faster-acting valve. The unit reportedly disassembles faster, operates faster, provides easier fingertip leverage, incorporates a removable siphon tube, and has the safety disk side-mounted for added protection against damage. Double-prong locking unit with one prong slightly sprung prevents locking pin from falling out when transporting unit.

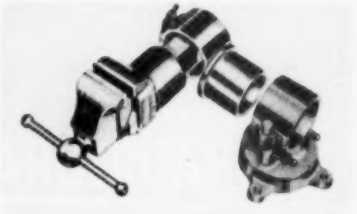
American-LaFrance-Foamite Corp, Elmira, NY

Knurling Tool Operates From Any Pick-Up Cam

Barnaby self-closing knurling tools are said to be quickly set up for high-speed precision knurling behind shoulders or at any distance from the end of the work, on both automatic and hand screw machines. Their balanced design reportedly eliminates all transverse thrust, preventing bending of the work and undue stress on spindle bearings without use of backrests.

The tool does not require special camming or synchronization of the lead and cross-slide cams, but operates directly from any pick-up cam. Sizes available: 1/16 to 1¼-in. dia.

Barnaby Mfg Co, 7½ Knowlton St, Bridgeport 8, Conn

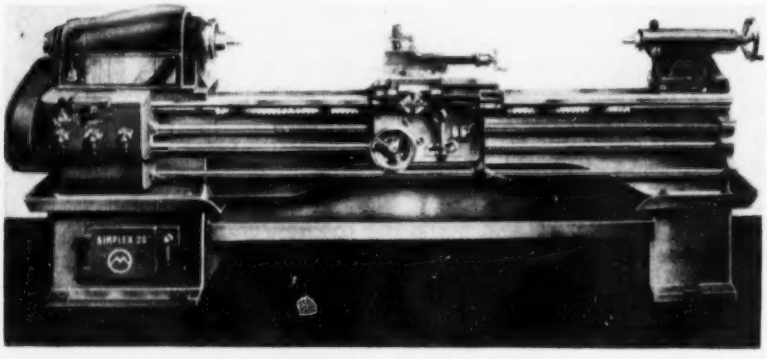


Bench Vise Rotates 360° In Any Direction

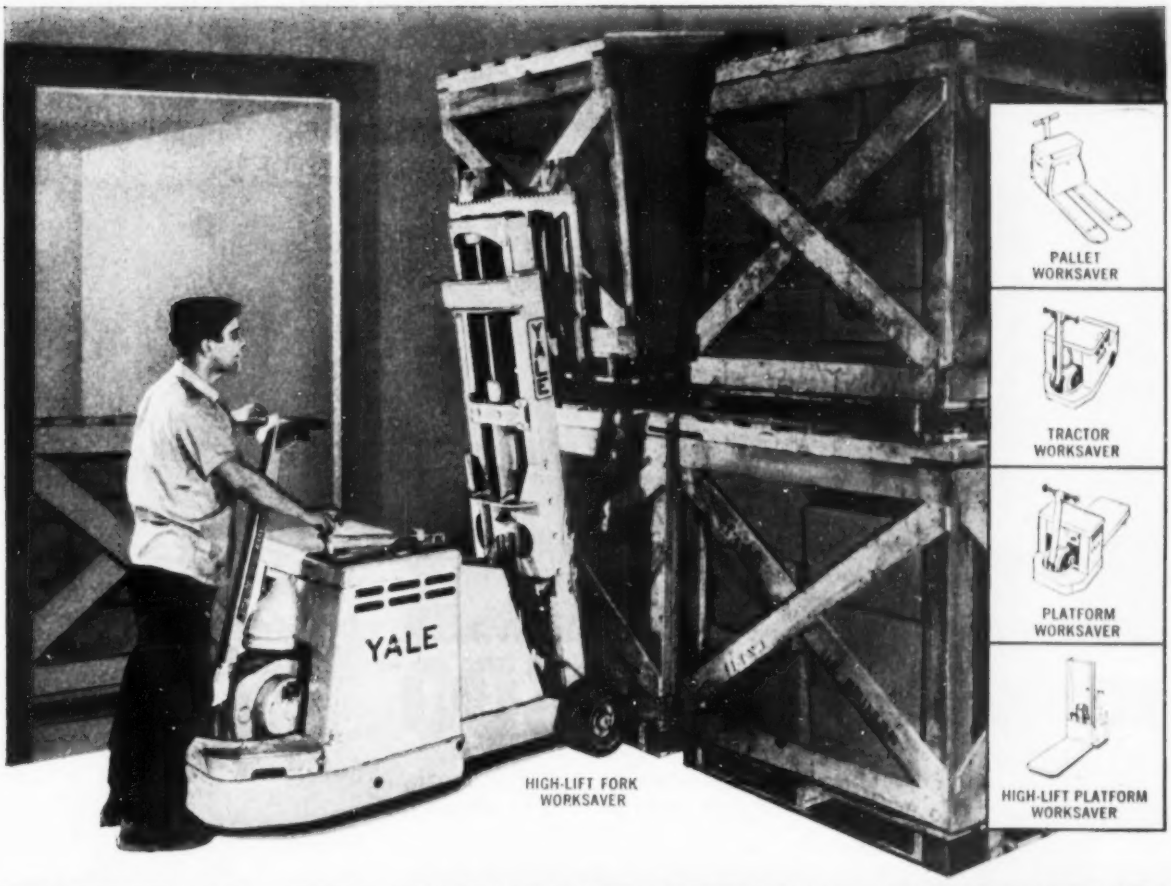
Flexivise has three major developments which facilitate handling of work. First, the entire vise assembly may be rotated around, cw or ccw. Second, by means of a swivel base that locks in any position, the vise may be turned right or left in a complete circle. The third adjustment is made possible by means of a special Flexisleeve attachment which gives the unit endless positioning range.

The vise has a 4-in. jaw size with a 5½-in. jaw opening. It can be raised or lowered, rotated vertically or horizontally, so that the work can be positioned to the operator. Large work held by the vise can rest on the table or be set on the floor.

Flexivise Co, 1149 East Pico Blvd, Los Angeles, Calif



SIMPLEX 20-IN. LATHE is available with 60 or 78 in. between centers. Gap bed is of removable-block type and swings to 30 in. Norton gearbox is fitted with spline shafts and gives a full range of American and metric standard threads. Gearbox incorporates Shear-pin safety device—*Morey Machinery Co, Inc, 410 Broome St, NY 13, NY*



YALE *WORKSAVERS*

give big truck power ...where big trucks can't go

Where size and weight rule out big trucks, YALE WORKSAVER ELECTRIC TRUCKS take over. Yes, YALE WORKSAVERS save industry time, manpower and money where low-load capacity flooring, unreinforced elevators and ramps had previously restricted materials handling operations to back-breaking manual moving, lifting and stacking.

YALE WORKSAVERS give big truck advantages...big truck versatility...at small truck cost! Features include forward and reverse power travel—hydraulic lift—complete range of use-extending attachments. Contact your local Yale Representative for a demonstration of the WORKSAVER line in your own plant...at your own time.

YALE*

MATERIALS HANDLING EQUIPMENT

**Registered trade mark*

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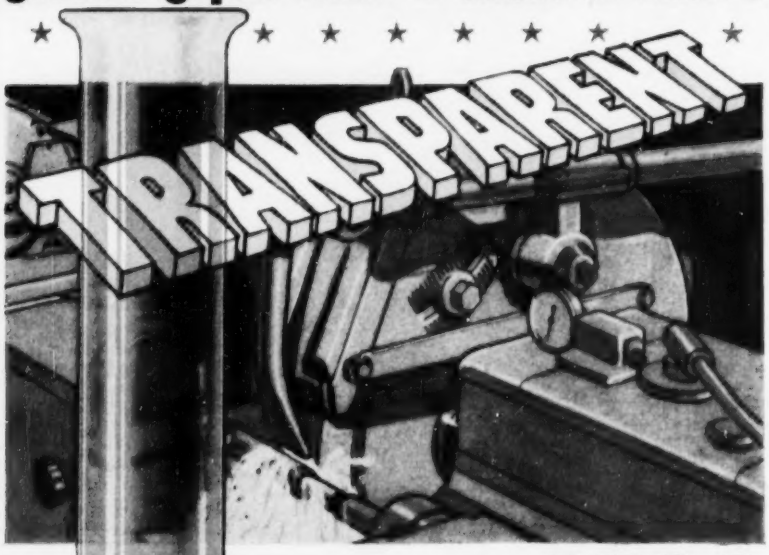
Gas, Electric, Diesel Lift Trucks • *Worksavers* • Hand Trucks • Hand and Electric Hoists • Pul-Lifts

You can do a better, more accurate grinding job with a coolant that's



ECONOMY LIQUID 1500

Enables the operator to see the work, gauge blocks or crayon marks clearly.

Constant observation of many grinding operations is essential and transparency is a big advantage in that the work may be observed while it is flooded with coolant.

There has always been a need for a transparent coolant for grinding. Several years ago The White & Bagley Company, originators of grinding lubricants, developed a grinding coolant that is not only transparent, but also provides these advantages . . .

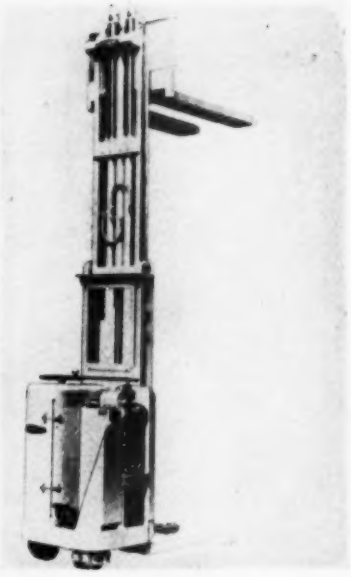
- Unusually open and free cutting wheels
- Extremely rapid chip settling
- Clean machines
- A coolant agreeable to the operator
- Excellent rust protection
- Freedom from foam
- Exceptional stability in storage
- A long-lasting "sweet" solution
- Parts are easy to handle — not slippery

ALL OF THESE ADVANTAGES AT A COOLANT COST OF ABOUT 1¢ A GALLON.

ECONOMY METALWORKING LUBRICANTS — THE WB CO

For detailed information on
ECONOMY METALWORKING LUBRICANTS
write for a copy of our latest catalog

THE WHITE & BAGLEY COMPANY
WORCESTER, MASS. • DETROIT, MICH.
Originators of Grinding Lubricants

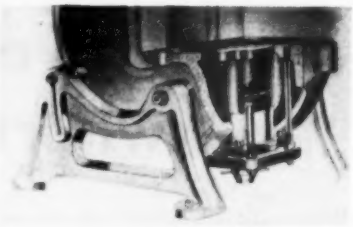


Telescopic Fork Truck

Raymond 2000-lb capacity telescopic fork truck has been added to the company's line of electric trucks.

Elevated height of forks is 132 in.; collapsed height, 83¾-in.; base forks and elevating forks 30 in. wide by 42 in. long, and dual tandem load wheels, make the unit especially adaptable for handling single-faced pallets and skid platforms.

Raymond Corp. 47102 Madison St. Greene, NY



Pneumatic Die Cushion Equipped With Internal Guiding Process

Model DB full universal pneumatic die cushion, designed primarily for inclinable presses, is completely self-contained and can be used with or without surge tank.

Internal guiding method compensates for off-center loading of the pin pressure pad, and can be machine-fitted to entire press bed opening. Combination reducing regulating valve and pressure gage assures constant pressure on the pad.

Cushions are available in eight sizes from 5 to 18 in., producing ring holding pressures of 1 ton through 14 ton on 100 airline pres-

sure available. In addition to use on all deep drawing operations, units can be introduced on pressure pad control on a large percentage of forming dies. They can also be provided for bolster plate mounting.

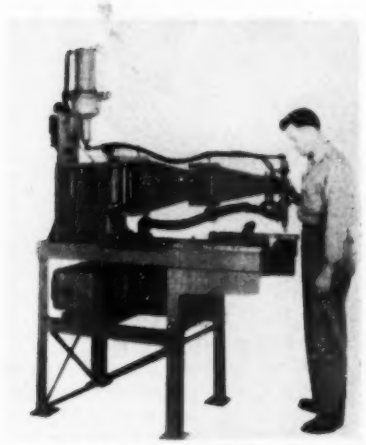
Dayton Rogers Manufacturing Co, Minneapolis, Minn

Martindale Model D-3 Demagnetizes Variety of Work

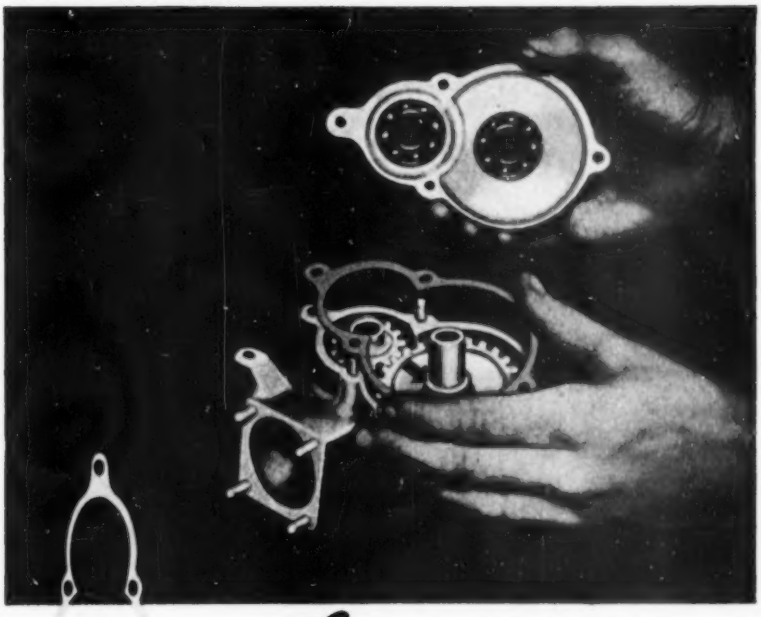
Model D-3 demagnetizer for removal of loose metal filings and chips from edges of cutting tools is available for large and small work.

Cutting tool is drawn slowly back and forth across the poles of the demagnetizer and then slowly drawn away. For larger parts, or in cases where it is not convenient to move the part, unit can be held upside down by its handles and passed over the part until its entire surface has been exposed. Switch and pilot light are at one end, next to handle.

The Martindale Electric Co, 1375 Hird Ave, Cleveland, Ohio



AIR-OIL BOOSTER-OPERATED SPOT WELDER is limited only by size and shape of work. Designed to handle a variety of jobs without expensive tooling, additional fixtures available make possible many more job combinations — *The Taylor-Winfield Corp, Warren, Ohio*



Shims stamped from LAMINUM® look like solid metal but actually are made up of from 3 to 63 layers of .002 or .003 inch brass or steel.

A "BUILT-IN" ADJUSTMENT THAT ACTUALLY COSTS LESS THAN NO ADJUSTMENT!

. . . there's less machining and you can "take up" after wear.

Think of this shim as an adjustment device. As used here, its cost was only 19¢. It's made of our exclusive LAMINUM®, has 16 layers of .002" brass in one unit.

It gives wide tolerances to the thrust gear housing, saving expensive machining time.

It precisely preloads the bearing. Inner race rests on the collar, marked by arrow. Outer race is "fixed" in the housing. Removal of a .002" shim lamination brings housing and outer race closer to main assembly. This gives the minute preloading adjustment for best angular contact bearing operation.

It "takes up" after wear. Removal of additional laminations makes simple, quick adjustment.

SHIM HEADQUARTERS SINCE 1913

Check Our Stampings Division For Your Stamped Parts Requirements

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Grinding Wheels

built for the toughest grind!

Heavy production snagging! Micro-inch finishing! Cutting off! Grinding in hard-to-reach places! Just name *your* toughest grind . . . and your Simonds distributor will supply the wheels to do the job right. And you can count on this satisfaction and dependability whether you buy Simonds grinding wheels, mounted wheels and points, segments or polishing grain. They're all quality-controlled products . . . second to none for efficient lasting performance and low grinding costs. Even if your toughest grind calls for *special* wheels, Simonds engineering service is at your disposal.

Write for free data book and name of your Simonds distributor.

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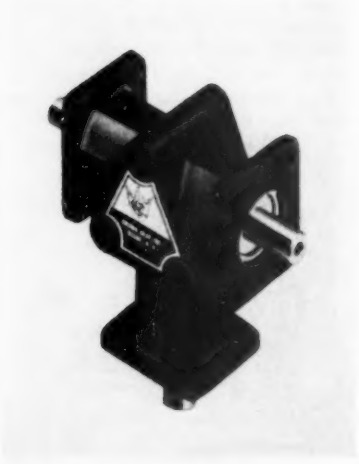
Division of Simonds Saw and Steel Co., Fitchburg, Mass. Other Simonds Companies: Simonds Steel Mills, Lockport, N.Y. Simonds Canada Saw Co., Ltd., Montreal, Que. and Simonds Canada Abrasive Co., Ltd., Arvida, Que.

Rack Stock Carrier

Tubular heavy-duty stock carrier has wire mesh sides for complete visibility. One-ton-capacity carriers can be moved as single units or as a trackless train, and may be stacked up to six high with a standard fork truck.

Sides drop down on hinges; two swivel and two rigid 6-in. roller bearing steel casters provide maximum mobility. Units can be ordered from stock or built in any size or capacity.

Rack Engineering Co, Connellsville, Pa

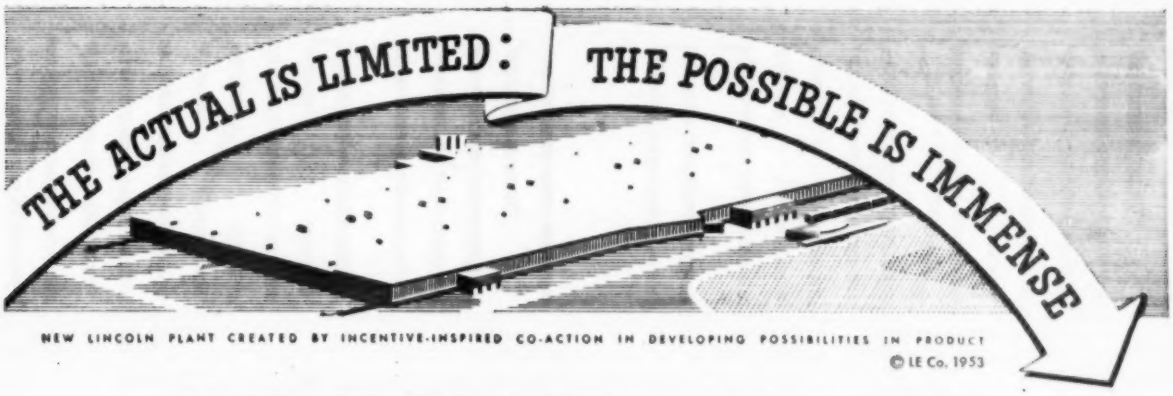


Miter Gear Boxes for Right-Angle Transmission

Crown miter gear units for transmitting power or motion at right angles are available with 1/3 hp and 1 hp at 1800 rpm. Each size has both a two-way and a three-way shaft extension, with a choice of five mounting facings.

The 1/3-hp unit has a static torque of 250 in-lb; static torque of the 1-hp model is 750 in-lb.

Crown Gear, Inc, 290 West St, Keene, NH



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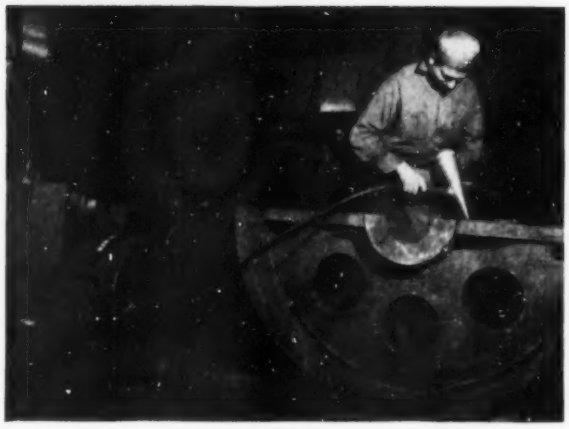
Full Automatics—*"Automatic Lincolnweld" . . . industry's standard for fast, low cost quality "hidden-arc" welding. Available for mounting on fixtures or for tractor mounting on heavy flat work. "Twinarc" head may be quickly mounted to increase welding speeds* 50% and more *using two electrodes with same "Lincolnweld" controls.*



Semi-Automatics—*"Manual Lincolnweld," commonly known in industry as "squirt welder" . . . leader in high-current density welding. Combines fast, low cost benefits of automatic welding with flexibility of hand welding. Easy to set up . . . the "Manual Lincolnweld" gun may be mounted in simple, low cost fixtures for flat and near flat work.*

Unique Agglomerated Fluxes—Cover 30% more footage at 45% less cost. In Lincoln Agglomerated Fluxes ingredients are held together with a simple binder . . . to retain *original identity* at the time of welding. The ingredients are not lost or changed in composition. *Every grain is identical!* Furthermore, alloys can be added to produce any type of weld deposit with mild steel wire. Fluxes 760, 780 and 840 are for automatic welding. Flux H-545 is for hardsurfacing for severe impact. Flux H-550 is for severe abrasion.

Automatic Electrodes—For mild steel

- L-60 . . . mild steel wire .12 carbon
- L-61 . . . mild steel wire .12 carbon silicon killed
- L-70 . . . alloy steel wire .14 carbon plus .5% moly.
- L-201 . . . medium carbon steel wire (.55 carbon)
- L-18/8 . . . stainless steel wire

"Automatic" Engineering—Benefit from Lincoln's complete application engineering service available throughout the country. Automatic welding specialists, located in every principal industrial area, will gladly analyze your welding needs, suggest the most efficient tooling and welding procedures for lowest cost operation. Call or write

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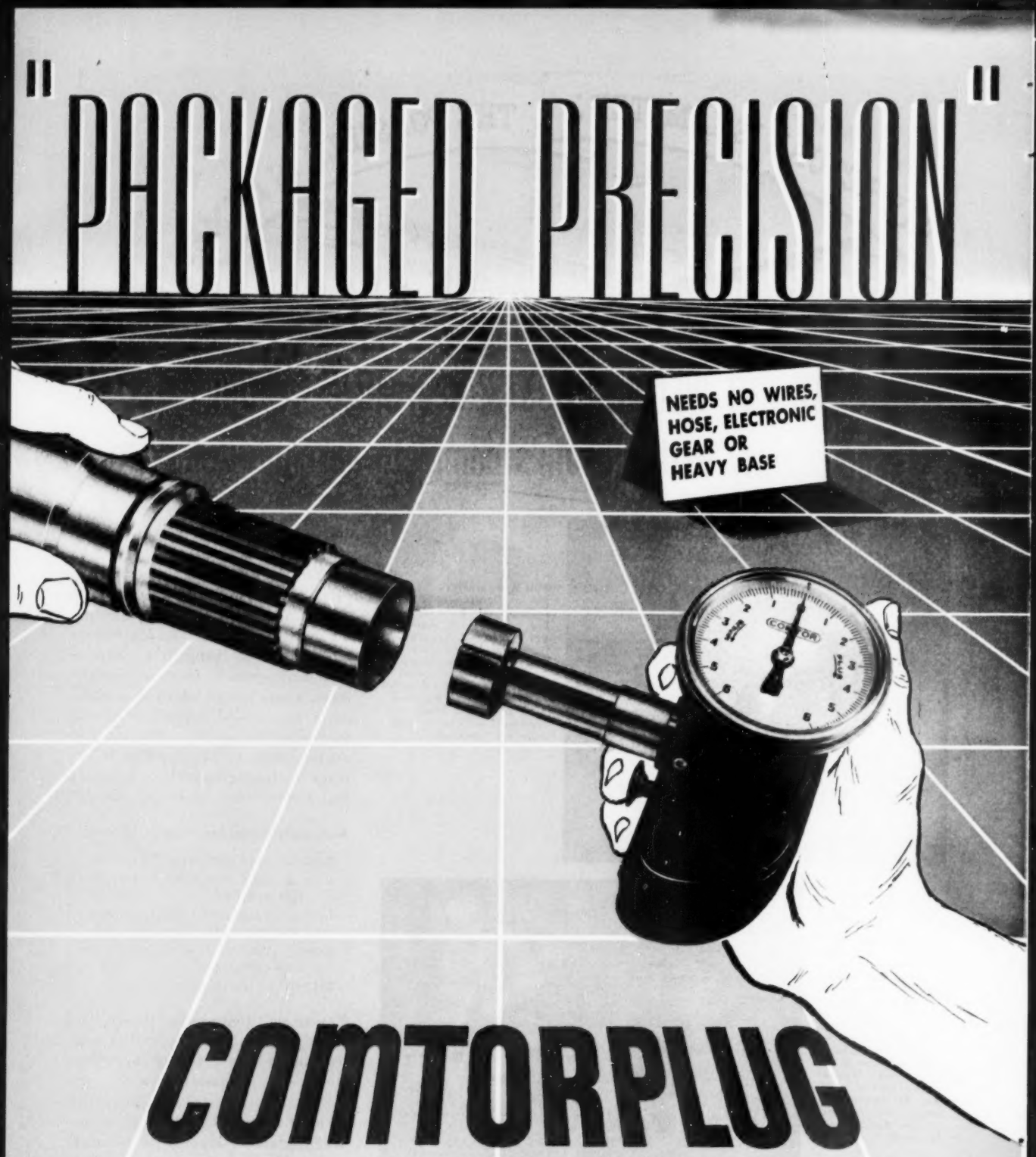

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ROUND TABLE Discussion

ANGLES — OR CURVES?

Is an employer justified in requiring a man to work overtime without ample warning? Can a worker justifiably refuse, if such emergencies are infrequent?

UNDER NORMAL CONDITIONS, a worker is expected to work normal hours and normal jobs. But when a tight production spot develops, if the worker is dependable and understands the nature of the emergency request for overtime, he will loyally respond. However, in fairness to all of his workers, instead of wearing a good man down with an overload of rush overtime work, the smart foreman will endeavor to spread the overtime jobs around. More than one worker should be available for extra assignments. From personal experience, I have found that workers will rise to fair challenges when the boss shows them he is depending on them to meet a critical work condition. And personal emergencies go out the window when company emergencies require overtime work.

It all depends on how the foreman puts it to a worker regarding having to work overtime. Suppose that you are a machinist in a small, efficiently run shop and a rush job comes up. If your boss tells you that you have to stay overtime for three days to get it finished on time you will gripe and feel sorry for yourself. But suppose that he says, "Joe, we have an important job here that we have to get out by Thursday noon. I'm going to turn it over to you. Will you see what you can do?" With such a trust, you will, if you

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parts: small connecting rods

alloy: "600" series metal, a high strength bearing bronze that contains no tin

quantity to date: over 2,000,000

number of failures: none

forged by: Mueller Brass Co.

advantages: no bearing insert is necessary on either the wrist pin or crankshaft end because each rod acts as its own bearing. Dense homogeneous grain structure, close dimensional tolerances and high mechanical properties often permit redesigning for weight savings as high as 15% to 25%. "600" alloys have low coefficient of friction, high resistance to corrosion and tensile strength 2½ times greater than cast phosphor bronzes.

uses: compressors, outboard motors, small high speed gasoline engines. Best results are obtained if they operate against hardened, ground and polished shafts.

"600" SERIES ROD is produced in standard 12-ft. mill lengths and a wide range of sizes and special shapes. This rod has a fine, uniform grain structure and the mechanical properties are rigidly controlled in the cold drawing process. Scrap loss is greatly reduced in machining operations because of the complete absence of defects. For complete information, write us today.

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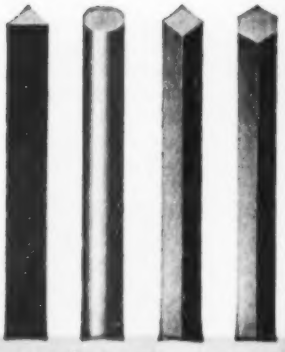

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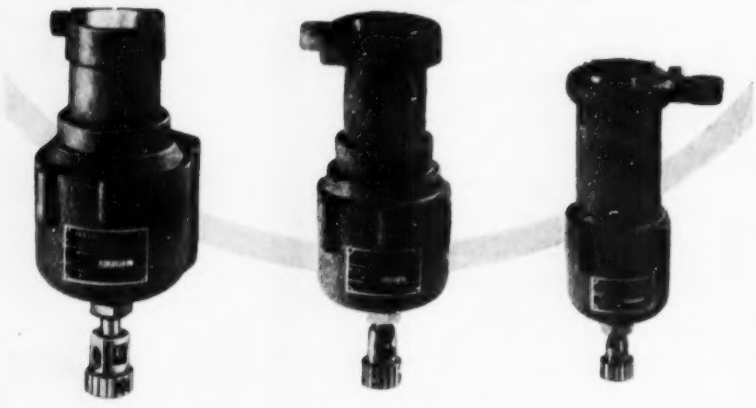

A complete range of Jarvis Torqomatics — available to fit any type drill press or tapping machine.

You'll like their trouble-free performance — their ability to produce quality threads — their increase in tapped holes per hour, the savings in taps — and their ease of operation!

We invite your inquiries about these highly efficient Jarvis Torqomatics that have outmoded all other slow, expensive and highly perishable machines of the past. Jarvis Torqomatics are priced low enough to make it economically possible to replace your old tapping devices and attachments.

A Jarvis representative will be glad to consult with you — no obligation.

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TAPS · FLEXIBLE SHAFTS
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THE CHARLES L. JARVIS CO., MIDDLETOWN IN CONNECTICUT

are normal, throw yourself into the job enthusiastically, work the extra time, and turn in a bang-up job.

In my opinion, a man's job includes the requirement that he work overtime during emergencies, when asked, provided the worker's emergency requirements are also respected by the foreman. From a theoretical standpoint, when a worker with an acquired skill hires out that skill he becomes morally obligated to for the benefit of his employer, and it is legitimate for the employer to expect him to do so. The employer is paying for the use of the worker's skill during the latter's working hours and is also privileged to go all-out in pre-empting his overtime.

The extent to which an employer can go in pre-empting the worker's overtime should be limited only by the extent and importance of the emergency, and whether the man has made any previous personal commitments which cannot be broken. Inasmuch as the shop is expected to run efficiently, and emergency requirements are part of every well-run shop, it would seem that a man's personal affairs should be subservient to the demands of his job, and any worker worth his salt would see his way clear to offer to help his foreman out of a tough spot. I would leave it up to a man's sense of duty and fair play to understand that the requirements of his job also cover the willingness to work overtime when requested. In my opinion, there is no appreciable difference between hourly paid and salaried men in this respect.

A foreman may make the mistake of thinking that the worker's refusal to work overtime is evidence of disloyalty and uncooperativeness, when in reality it may be due to a bona-fide emergency. The foreman makes

"Say! You haven't been to see us at the shop for a long time . . . what are you doing these days?"

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(UP TO 2200° F)

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If improvement of your product or process depends upon use of extremely high temperature, while minimizing its destructive effects, use Kentanium at the critical points.

WHAT is Kentanium?

Chiefly titanium carbide (and small percentages of other refractory metal carbides), with nickel "binder". Uses neither tungsten nor cobalt. Hardness: Up to 93 RA. Weight: ⅔ that of steel.

WHAT can it do?

Resist thermal shock, withstand oxidation and abrasion, retain great strength at high temperatures (1800°F and above).

WHERE is it in use?

Successful applications include: Valves, valve seats, reduction crucibles, anvils for spot welding, hot extrusion die inserts, bushings, thermocouple protection tubes, flame tubes, furnace tong tips, balls for hot hardness testing, nozzle vanes and blades for jet engines, and many others.

WHAT forms are made?

Tubes, rods, bars, flats by extrusion process. More complex parts by machining from pressed slugs before sintering; extremely accurate parts by grinding to required tolerance after furnace sintering.

HOW can you use it?

This remarkable new metal, available in many "grades" to meet specific combinations of imposed conditions, can best be adapted to your high temperature problem by cooperative effort. Our engineers will be glad to discuss how you can get best results from Kentanium.

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KENTANIUM

HEAT-RESISTANT, HIGH-STRENGTH, LIGHTWEIGHT CEMENTED TITANIUM CARBIDE

See KENTANIUM demonstration—Basic Materials Show, N. Y.—SPACE 59C

the mistake of thinking ill of his employee because his actions do not conform with the foreman's idea of how he should behave under this condition. A friendly approach and frank discussion will bring out the true facts without recrimination or ill feeling.

Just because a man is paid for overtime work is insufficient reason to expect him to willingly assume the added burden of overtime. Many men don't complain when forced to assume the overtime although a personal emergency may exist that requires the man's time after his regular day's work. Silence does not imply consent to overtime work. Some foremen are so used to hearing complaints that they lose their sense of proportion in dealing with a type of worker who doesn't complain even when there is justification for complaint. Such a situation reminds me of the wife who said to her husband, "You'd better get up and see why the baby's not crying."

The wise foreman will take into consideration the worker's rights to after-work commitments. It is better to be able to retain the services of a good worker than to do him the disservice of forcing unwanted overtime work upon him with deleterious effect on his future value to the organization. Delegating the rush assignments to other members of the force who are in a better position to accept the overtime work will do much to foster morale.

Of course, a worker's loyalty to the shop demands his renunciation of any minor previous commitment he may have made that will inter-

"I used to work in this shop. I last a few parts . . . could you make them while I wait?"

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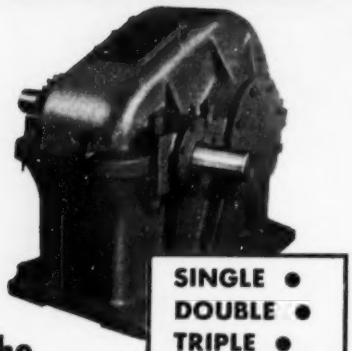

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fere with getting out a rush job by the overtime route. It is difficult for a foreman to so schedule his work that emergencies will not cause disruption to the flow of work in the department. However, some leeway should be allowed to cover any emergency jobs which may arise.

A work schedule should be flexible enough to cover any hot jobs that may arise. No one man should be indispensable. To cover emergency or unforseen special work, the foreman should have a reserve of trained men available. Problems of this nature require the demonstration of real foremanship. The foreman is certainly on the horns of a dilemma in endeavoring to meet company needs in getting out the emergency work and still take cognizance of the personal emergencies of the workers.

Morale is the spirit which vitalizes an organization. It is composed of confidence, loyalty, and cooperation. Confidence and loyalty are closely related. Confidence in management gives rise to organization loyalty, while organization loyalty in turn bolsters the employee's confidence in those who control the organization itself. Both in combination result in cooperation between those who work for the organization and those who direct its activities. Confidence, loyalty, and cooperation are fostered when employees are treated as human beings and their rights respected.

A worker will not take advantage of a foreman who treats him as a person. His loyalty and enthusiasm for his foreman and firm is usually commensurate with his attitude toward his job. It is of importance, therefore, that grievances and problems which are irksome to employ-

"Can I get anything for you? A smoking jacket? A pipe? A dismissal notice?"

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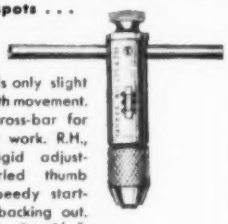

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save $11 every 8 hours on one machine!

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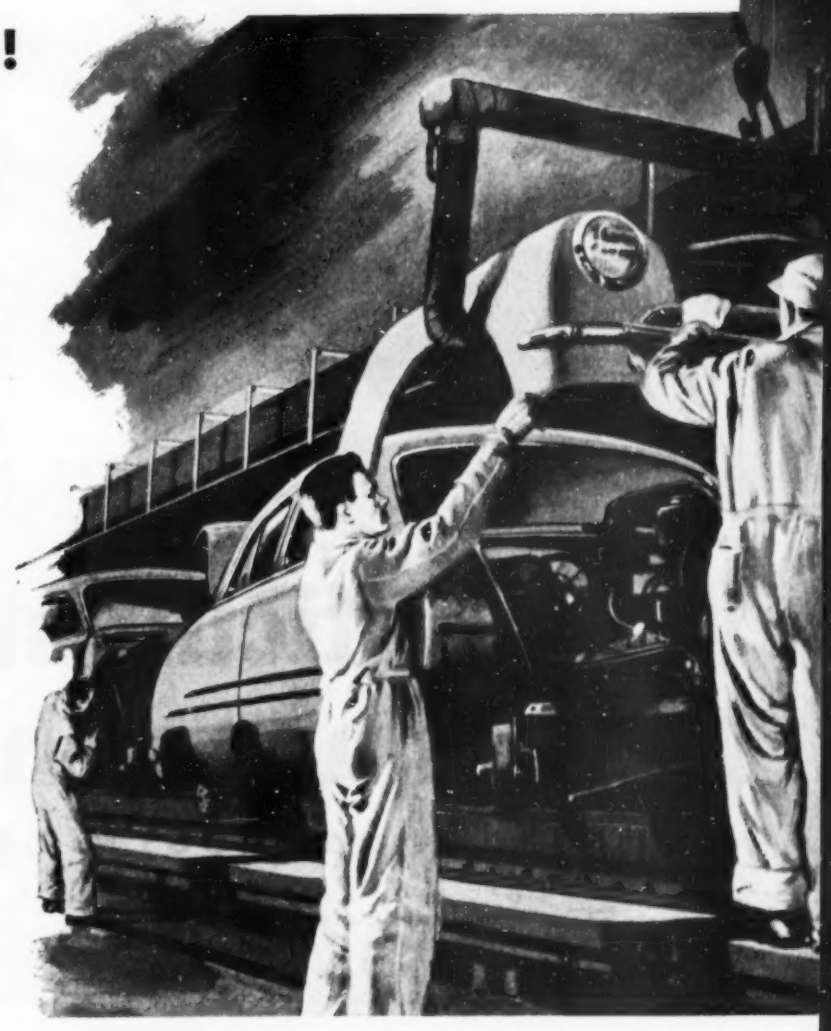

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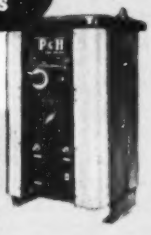

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ees and which destroy morale should be recognized and adjusted. It is merely confessed foreman-incompetence which minimizes these maladjustments in morale on the ground that friction must exist wherever human beings work together, or assumes that all matters requiring adjustment will eventually come to a head.

Time and experience have demonstrated that most troublesome problems of foreman-worker relations result from an accumulation of seemingly minor matters and lack of attention to what men are thinking and want from their jobs. Eruptions in human relations can be avoided only when foremen understand workers' attitudes.

The foreman who believes that "you can go too far with that sweetness and light stuff," in his relations with his men and that "you can be so easy that the men take advantage of you," lacks intelligent leadership qualities. All employees seek and respect intelligent leadership. The leader who inspires others to do for him is rapidly supplanting the hard-boiled individual who is always afraid of acting human for fear his men will take advantage of him.

To be a good leader, one must have a good understanding of industrial psychology. It is essential that the leader understand impulses and instincts. This will help him understand the emotions and reactions of persons working under him. With this background he should be in a position to interpret the needs of his group and to direct their affairs so that they achieve the objective they feel are significant and worth working for.

When employees are assigned work for which they are qualified and are paid accordingly, their loyalty and cooperation will bar any

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14" South Bend Economy Model Bench Drill Press

Ruggedly constructed for machine shop service. Drills to center of 14-1/4" circle. Free-floating spindle. Four precision ball bearings. Time payment plan is available.

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Write for catalog of 14" Drill Presses. Also, 9" to 16-24" Lathes, Lathe Attachments, 7" Shapers — specify machine interested in.

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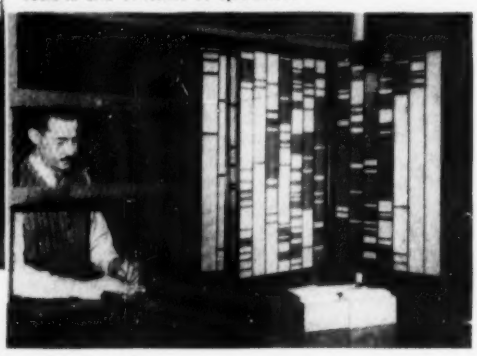
Boards below list and locate all tools, jigs and fixtures and provide visible record of tools drawn by each employee. Cabinet at left contains complete records of all tools in crib or issued to operators.



DAYTON PUMP benefits 10 ways

.....saved $12,957 with McCASKEY TOOL CONTROL

In the first three months of their use of McCaskey Tool Control, the Dayton Pump and Mfg. Co. reduced tool expense $12,957 and attained the continuing results outlined below. Here are ten of the reasons why they are enthusiastic over results as briefed from facts received from Mr. Louis Wozar, Vice Pres. and Assoc. Gen. Mgr.:

1. **Idle Tools Recovered** . . . inventory of all special and standard tools, taken during McCaskey installation, revealed amazing quantity held in tool boxes and benches for only occasional jobs.

2. **Tool Inventory Reduced 20%** . . . by requiring operators to return tools not in use . . . by determining (1) proper inventory levels and (2) quantities to be purchased through tool usage records.

3. **Less Tool Breakage** . . . McCaskey procedure has made operators "tool conscious" and careful, reducing breakage.

4. **Crib Performance More Efficient** . . . McCaskey Index and Location Boards instantly provide tool number, description, size and location of all standard tools, special tools, jigs and fixtures; also show whether used on active or service parts and facilitate storage of more tools in less space.

5. **Arguments and Accusations Stopped, Productive Hours Increased** . . . tools in operators' possession quickly, definitely located.

6. **Blueprints Quickly Located** . . . eliminates confusion and delay, when prints are recalled, and prevents costly errors from use of obsolete prints not turned in or found.

7. **Accurate Tool Usage Records** . . . now available for quick check-up on performance data and obsolescence.

8. **Perpetual Inventory** . . . accurate, up-to-the-minute record of available tools easily maintained by positive procedure.

9. **More Productive Time for Machines, Tools and Men** . . . thru faster crib service . . . no lost motions . . . no dependence on attendants' memory . . . no laborious clerical work.

10. **Efficient Operation with Inexperienced Attendants** . . . new personnel quickly and easily trained for smooth, efficient operation.

These advantages point to continued savings for Dayton Pump . . . and for you, too. Investigate NOW! Mail coupon for step-by-step procedure and additional facts.

THE McCASKEY REGISTER CO.
ALLIANCE, OHIO

Send me the facts on McCaskey Tool Crib Control.

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objection to helping their company meet an emergency. They know that the company will help them if ever a personal emergency gets out of hand.

Harry Kaufman
Philadelphia, Pa

•

LAMBS OR GOATS?

Will company dinners and similar entertainment tend to bring workers and management into closer understanding, or will the men feel their after-hours are being invaded?

NOTHING BUT GOOD can result from informal get-togethers of workers and management. A number of misunderstandings are cleared up thereby, and the contribution to more harmonious relations between labor and management is a big dividend on the money laid out on such functions.

In a well organized and managed industrial organization there is very little opportunity for workers to get to know each other, particularly those who are engaged on different shifts, or who are employed in departments widely spaced in the plant. It is well known that feuding is resorted to between day shift and night shift, and between, perhaps, inspection and production. In a plant in which all are concentrating on their jobs during the working period, there is scant opportunity for fraternizing and discovering that those frigid robots in the inspection department, for instance, are intensely human individuals who are really likeable fellows.

The same applies to executives. The average boss has a special face which he puts on during working hours in the plant. Since this is the only face which the workers know, they are apt to assume that he has no sense of humor, and pity his wife and children for being saddled with such a sourpuss.

In my early days I had one boss who was never seen in the plant without his hat on. I used to wonder how he looked without it, and found it impossible to imagine. I visualized him even lying in bed with it on his head. It was not until he threw a party to celebrate the first ten years of the firm's establishment that any of us realized that he had hair and plenty of it. At this same party we also found, to our surprise, that he could be extremely amiable, and was really a human being at heart.

This first party was really a turn-

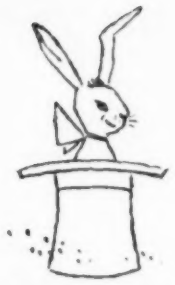
ing point in the relations between the boss and many of his employees, because they finally realized that he had a special face for working hours, the grimness of which he emphasized by means of the hat. The party became an annual event in time, and was money well invested.

If a firm has never had an annual shindig before, there are bound to be a lot of employees who prefer to stand aloof and to make excuses to stay away. There seems to be a prejudice among some against associating with workmates on their own time. I think the main reason for this is the fact that they cannot visualize what their fellow workers are like outside the plant. It is safe to say, however, that once the first social evening has been launched, it will be a big success and lay a firm foundation for similar events. All who go will have a good time, and will talk about it for months afterwards.

Informality is essential in factory social events if they are to go over with a bang. Any attempts at imposing formal dress, for instance, should be strangled as soon as suggested. The possibilities of bringing wives and girl friends should not be ignored, and every effort should be made to invite them. It is a break for the women, and the men like to show off their wives to their workmates.

In order to ease tension and get the party going, it is a good idea to have a short entertainment, preferably by hired professional performers, with a funny man predominating. Do not try to use local talent from within the plant, as it may cause resentment against the performer, who may be branded as a show-off. Talent from the plant should only be used in organized concerts and the like, in which a

"The boss hired him to change light bulbs!"



MAGICIANS

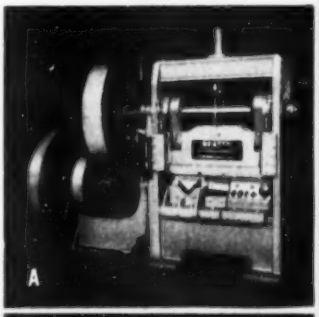
We don't pull rabbits out of hats. Our specialty is designing and building machines that work like "magic" in solving many heavy metal working production problems. The machines shown are typical examples. One of them may be just the answer for your personal production problem. If not, our broad experience in varied fields of the metal working industry enables us to design and build the ideal machine to meet your specific demands.

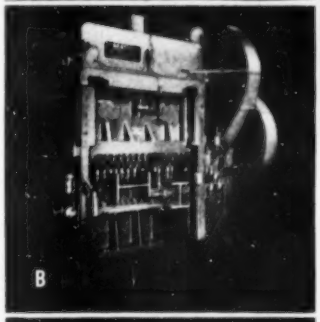
A. BEATTY Guillotine Bar Shear for "short order" shearing of bars, angles, rounds and squares.

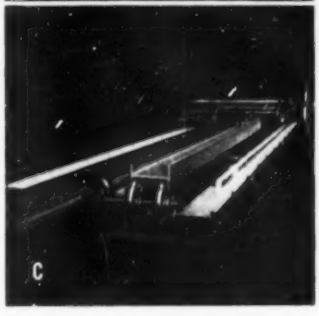
B. BEATTY Guillotine Beam Punch. Punches webs and flanges in "I" beams from 6 to 30 inches.

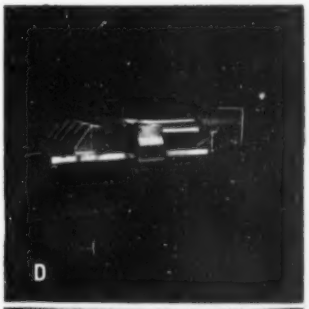
C. BEATTY Spacing Table handles web and flange punching without roll adjustment.

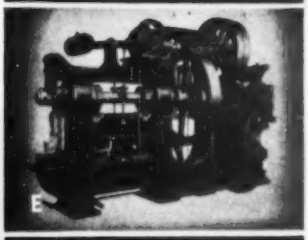
D. BEATTY Horizontal Hydraulic Bulldozer for heavy forming, flanging and bending.

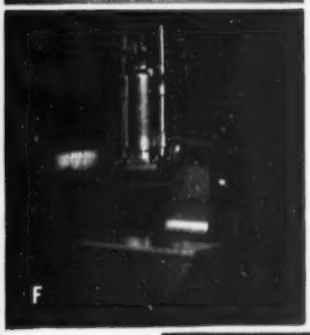












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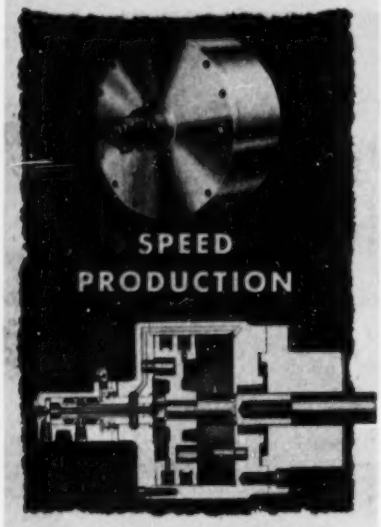
MACHINE & MFG. CO.
HAMMOND • INDIANA

E. BEATTY CoPunShear, one unit that does coping, punching and shearing without changing tools.

F. BEATTY Gap Type Press for forming, bending, flanging and pressing. Capacity 250 tons.

ROTATING AIR CYLINDERS



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Piston packings "replace" themselves by expansion from air pressure... practically eliminates repacking downtime. Aluminum or alloy iron housing. Non-adjustable, chevron-type rod packing. Long stroke. Balanced for high r.p.m.

Installed as original equipment by Bardons & Oliver, Cleveland Automatic, Cone Automatic, Monarch, National Acme, Warner & Swasey... and others.

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large number of diverse performers can participate.

For most of the social occasions at which I have been present in Britain, drinking has been found to ease tension and awkwardness and, since we are a beer-drinking nation, we do not have much trouble from excessive consumption. I don't know how this would work out in the US, owing to the puritanical views on drinking held in some parts, but we find it adds considerably to the enjoyment of an evening out. It is usual to hand over the management of the food and drink to a firm of experts; they will give an estimate of the price per head, and can usually be relied upon to stick close to the estimate. A certain quantity of wines, beer, and spirits is provided by the caterer, and when this is consumed, the bar closes. I have never yet known a party at which the liquid refreshment dried up, however.

When the sexes are mixed it is a good idea to arrange for dancing with long intervals between items, so that time is available for mingling and fraternizing. If it is a stag party, liquor and a short professional entertainment are essential. It is a very sound idea to arrange table places so that rivals or total strangers are placed side-by-side. Rivals will finish up the evening embracing one another, swearing eternal friendship, and the strangers will be in an almost similar mood.

Any manufacturing organization of any size can benefit from a social evening, and I urge all firms who have never done so to give it a trial. It is the best way of breaking down tension and bringing about a close understanding of viewpoint between management and employees.

Clifford T Bower
London, England

•

SHOP WORN

What is the best way of handling the case of a shop foreman who appears to have outlived his usefulness? Is the company to blame for not providing him with sufficient opportunities to keep abreast of new developments as they come along? Should the man be offered a lesser job, and kept on for the benefit of his years of experience?

THERE IS a very strong possibility that the management is mostly to blame for Burke's inability to keep up with the accurate and high pro-

(Continued on page 249)

CUT BAR STOCK up to 5/8" Diameter

Accurately, Instantly with a DI-ACRO* ROD PARTER

The shearing-breaking action of a Di-Acro Rod Parter allows most bar stock to be cut without burr and distortion. After parting, the bar is easily inserted into a hole its same diameter and the end can be threaded or riveted without further processing.

Holes in cutting heads accommodate eleven different round stock sizes. Also special heads for cutting square, and other shaped bars.

BOTH HAND AND POWER MODELS AVAILABLE

Instantaneous cutting action with Di-Acro Power Rod Parter. Rate of production is limited only by speed with which stock can be fed. Motor driven flywheel, other moving parts housed in welded, steel cabinet.

*pronounced Die-ack-ro

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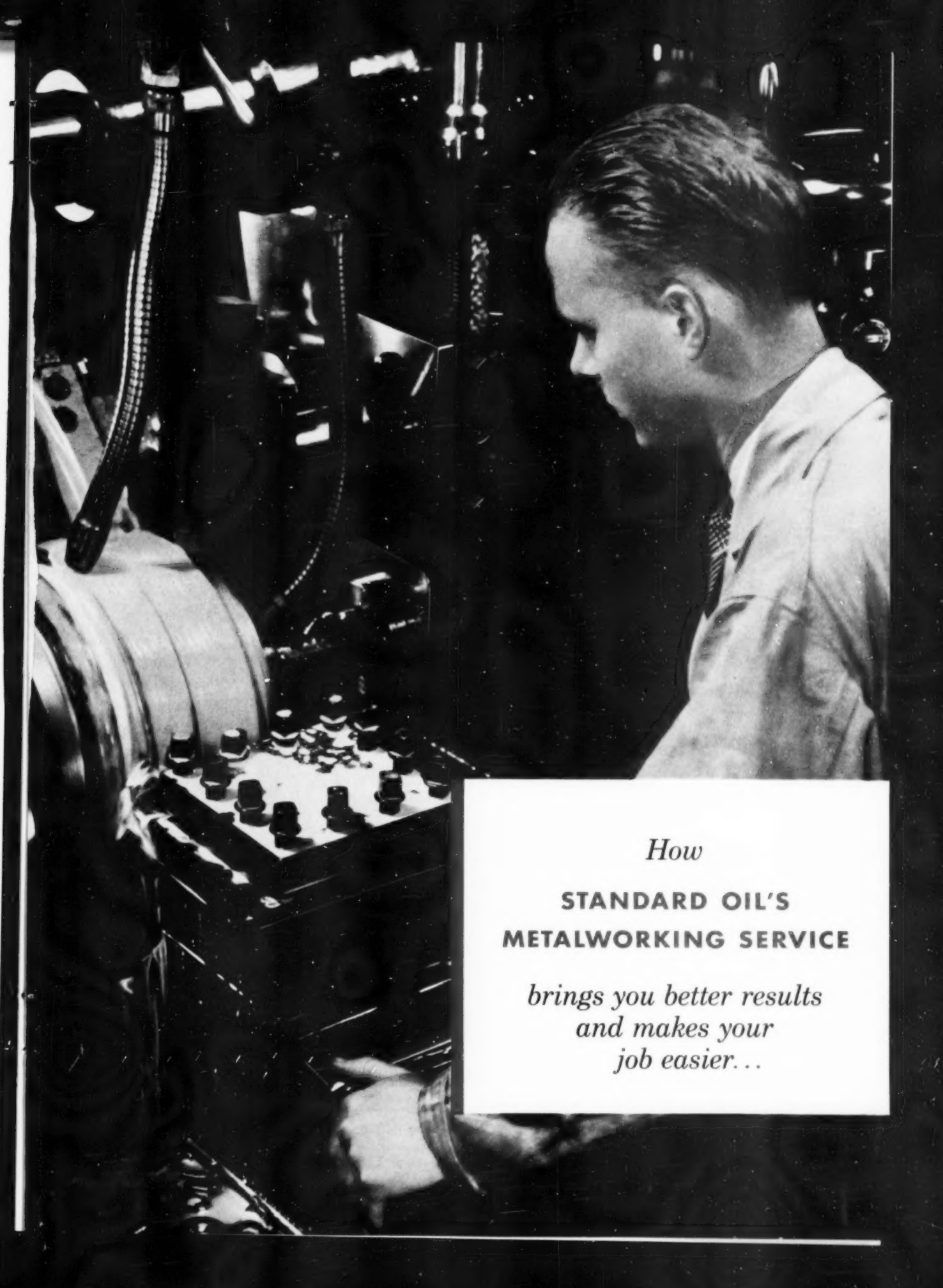


How

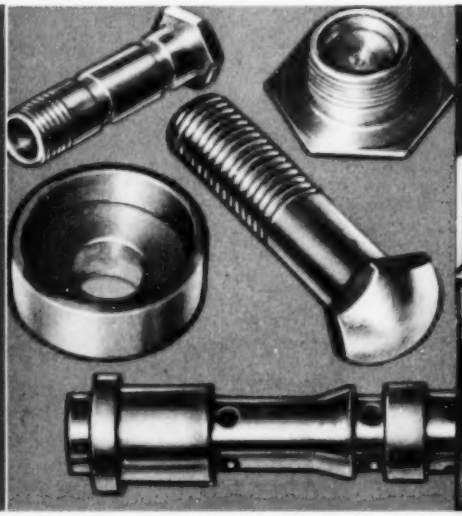
STANDARD OIL'S METALWORKING SERVICE

brings you better results and makes your job easier...

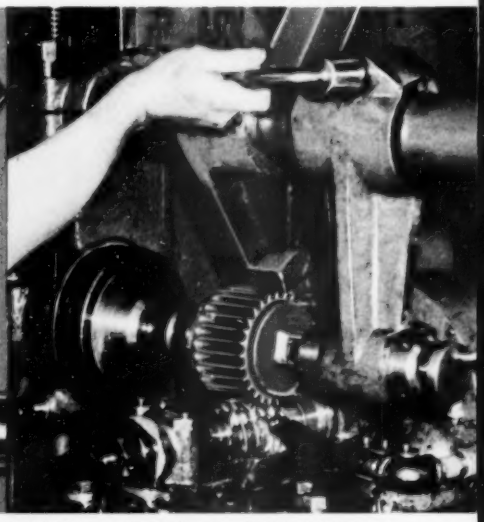
Standard Oil's Metalworking Service brings you the right product...for the right job...right on schedule!

There's no other like it in the Midwest! Standard Oil's Metalworking Service is completely personalized to meet your individual needs. It brings you one of the most complete lines of metalworking products on the market. It offers you the help of a specially trained, experienced metalworking specialist who has headquarters near your plant. It gives you delivery of metalworking products from a warehouse that's right in your own backyard. Described here are the outstanding products in Standard's complete line. You'll find exactly the ones to give you the best results.

STANICUT 62FC **increased screw machine production** of aluminum alloy valves from 97 to 125 per hour . . . gave better finish and longer tool life – 5,000 pieces between tool grinds. This light-colored oil is ideal for tough non-ferrous jobs.



STANICUT 107 BC **handled wide variety of operations** for midwest plant. Metals machined include brass, copper, bronze, aluminum, and steel. This cutting oil gives fine results on high speed operations using free cutting steel where requirements are not too severe and low cost is important.



PREMIER **Cutting Oil extended hob life 75%** and increased production of spur gears made from free machining steel. Available in two grades, Nos. 110 and 150, this sulfurized and compounded oil meets demands for a low-priced, light-colored, general-purpose cutting oil.

ACME **Cutting Oils cover wide range of operations.** They are dark-colored, sulfurized mineral oils. Grade No. 80 for high speed automatics . . . No. 110 for general automatic work, deep drilling . . . No. 150 for high speed operations and broaching . . . No. 200 for low speed operations and severe work.

STANICUT Cutting Oils are special-duty products developed to meet today's most exacting requirements and highest production schedules.

STANICUT **Oil 117 BCS** for high speed operations where steels of lower machinability than free cutting screwstock are used.

STANICUT **Oil 126 BCS**, relatively light colored oil, contains right amount of active sulfur for rather severe, high speed operations.

STANICUT **Oil 137 BCS** has a high sulfur content and special compounding for severe, high speed operations on either turret lathes or automatics. Suitable for either brass or steel.

STANICUT **Oil 155 CS**, containing maximum active sulfur and chlorine, for very tough alloys of SAE 3000 and 4000 series, especially those that tend to "smear."

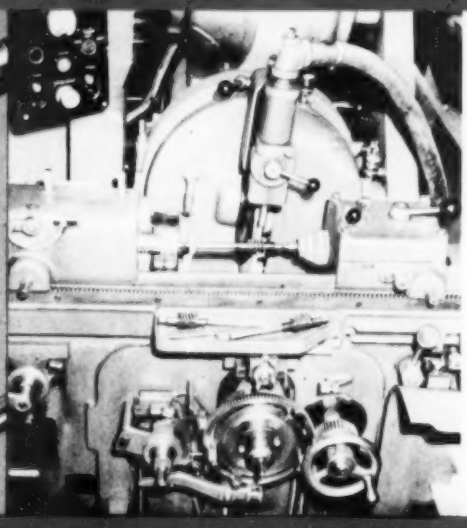
STANICUT **Oil 166 BC** – may be used as a dual purpose oil for those desiring this type of product – non corrosive, provides lubrication for bearings yet chlorinated and compounded sufficiently for cutting operations on free machining steels, brass and copper.

STANICUT **Oil 208 BCS**, high sulfur and chlorine content, yet good color and odor . . . for tough alloy steels and severe operations.

STANICUT **Oil 309 BCS**, a sulfurized and chlorinated oil, for heavy broaching, threading, and tapping of soft stringy steels. Can be blended with paraffin oil to handle less severe work.

SUPERLA Soluble Oil provided excellent finish on saw blades made from high carbon steel . . . prevented any rust troubles. This general-purpose soluble oil coolant emulsifies readily in all waters. It is stable, non-gumming, non-irritating. **SUPERLA Soluble Oil No. 2** is a lighter soluble oil especially suited for use with soft to medium-hard water.

STANICOOL Hd Soluble Oil handled more jobs for a midwest plant than could conventional soluble oils, gave good results in tapping, threading, drilling, and milling of high carbon, high chrome steels and stainless steels. Special compounding enables this oil to handle severe cutting jobs.

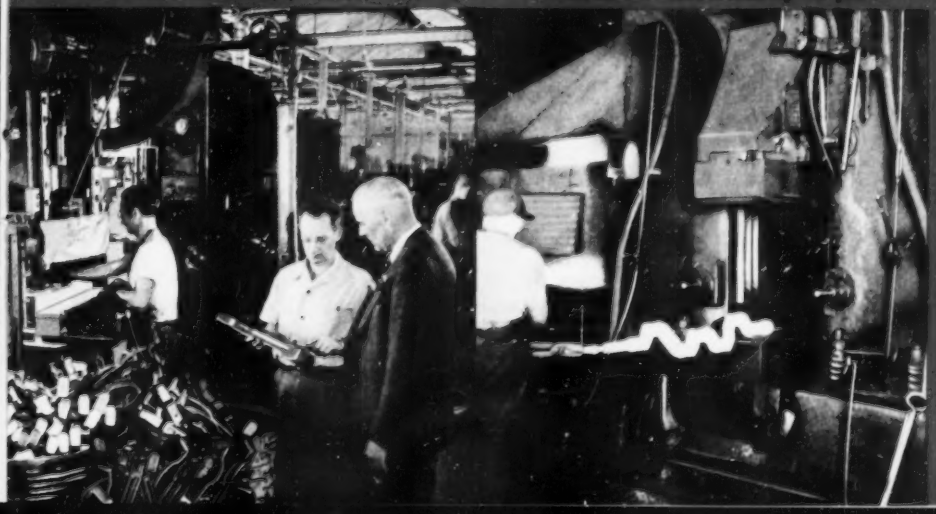


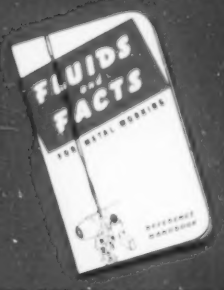
SUPERLA Thread Grinding Oil "A" stopped burning of surfaces on worm gears, increased grinding speed 20%, gave finish of between 14 and 20 microinches. Each of three grades has the proper viscosity, compounding, sulfur and chlorine to produce best results in service intended.

STANDARD

STANOSTAMP Compound "C" cut die polishing on this stamping job—90,000 more pieces between polishings. Two grades of STANOSTAMP meet widest requirements found in sheet metal processing: Grade "C" for average jobs, easy removal . . . Grade "S" with sulfur for heavy jobs.

STANOLIND Forge Die Compounds have increased materially life of dies and tools in forging of hot metal. STANOLIND "Medium" has heavier consistency for general work. STANOLIND "Heavy" is especially suited for intricate forging. Both can be applied by swab, further distributed by air jet.





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Standard Oil's Metalworking Service makes your job easier three ways... bringing you all of the metalworking products you need...

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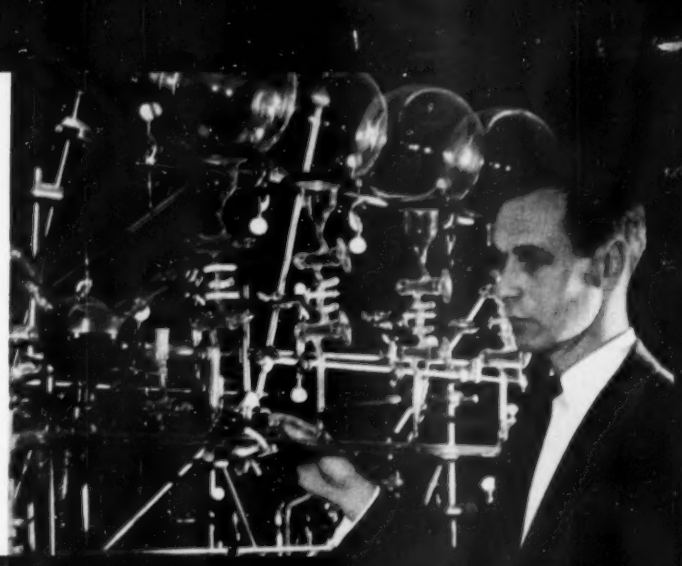
Standard's large, modern refineries produce and assure consistent high quality.



2 *Sold by trained metalworking specialists*

Standard's metalworking specialists bring you the benefits of special training in Standard's own Engineering School and a wealth of job experience. One of these men has headquarters near your plant. He will work closely with you, give you the help you need when you need it, to make your job easier.

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Wherever you are in the Midwest, there's a Standard warehouse and office right in your own backyard! Adequate stocks of the metalworking products you need are near at hand . . . no need to stockpile oils in your plant . . . no need to worry about delivery delays. A local phone call brings you the product you need, delivered promptly to your plant. It helps make your job easier and operation in your plant more efficient.

Call your nearby Standard Oil metalworking specialist

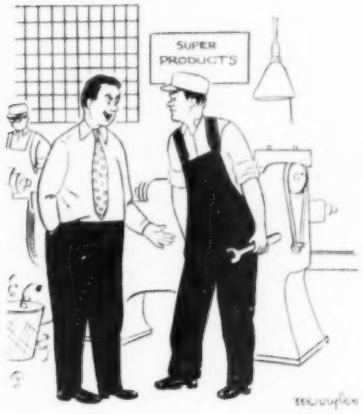
Put Standard Oil's personalized metalworking service to work for you. Phone your local Standard Oil (Indiana) office.

STANDARD OIL COMPANY STANDARD (Indiana)

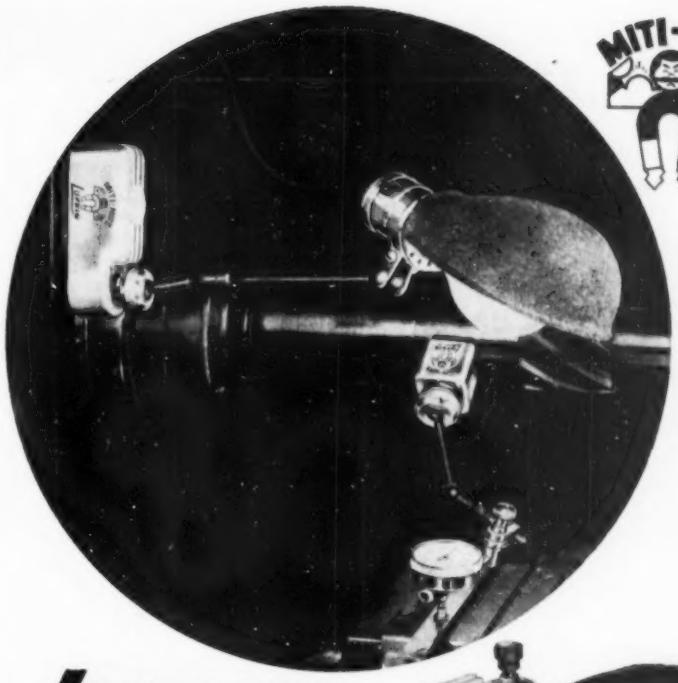
duction ability of the latest machines and methods. Burke is possibly somewhat of an introvert, and his pride has prevented him from protesting against the lack of consideration and good sense on the part of his superiors. I know of a very similar case where the foreman of a large machine shop—let us call him Jessop—almost lost his position for "lack of progressive planning and failure to get the maximum production out of his machine tools."

Jessop had been assistant foreman and then foreman of the large shop for 24 years. He was slated for a layoff because he did not seem to be able to get the production that the new machines were anticipated to be able to give. This firm, however, was very fortunate in having for its personnel manager a man who really checked into things before making a decision. When he was told by the general manager to put a "go-getter" in Jessop's place, he would not accept it as final because he wanted to first find out why Jessop was not up on these things; Jessop was a bright and intelligent man.

A few days later, the personnel manager had a diplomatic talk with Jessop. During this conversation, he discovered the following: (1) Never once during the last 24 years had Jessop ever been scheduled to attend a single one of the machine-tool exhibits in the nearby large cities. The superintendent and the chief engineer were always sent with all expenses paid, but Jessop, the foreman who had to plan and try to get the production from all the new tools, had never had an opportunity to discuss the details of production with the experts who ran these tools and systems at the various exhibits. (2) Every time an engineer salesman was called in to discuss the best tool



"My wife's brother will be in—I'm giving him a job so I can have the pleasure of firing him!"



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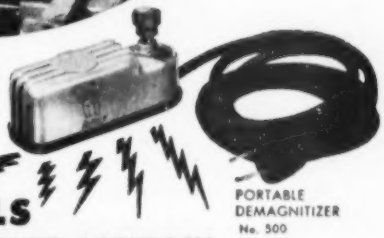

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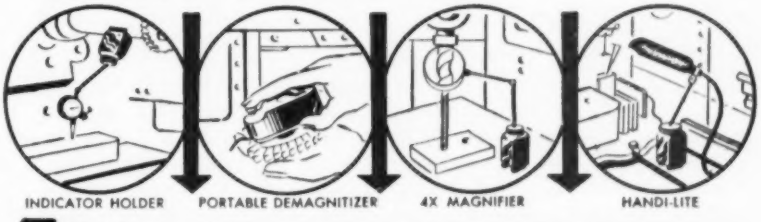

7 BASIC TOOLS WITH HUNDREDS OF SHOP APPLICATIONS.

All of the tools, accessories, and applications cannot be described here — send coupon for completely descriptive booklet. **Indicator holders** increase accuracy and save time by eliminating haphazard clamping. **Handi-Lites** light those hard-to-see places. **4X magnifier** is invaluable for inspection, precision drilling, reading vernier scales, etc. **Lightweight portable demagnetizer** is the tool industry has been waiting for.

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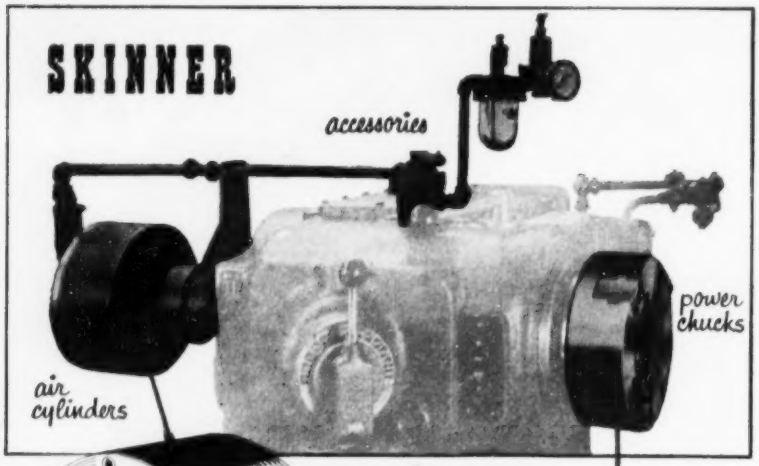
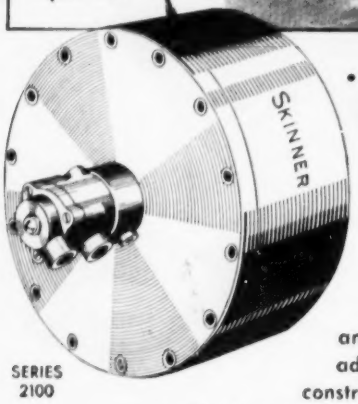


power chucks

air cylinders



SERIES 2100

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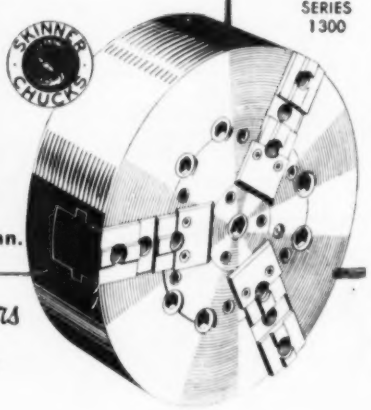
Write for catalog giving complete details on the Skinner line of power and manually operated chucks. And ask about new movie "Chucks and Their Uses" — available for free showings.

SERIES 1300



THE SKINNER CHUCK COMPANY

203 Edgewood Ave., New Britain, Conn.

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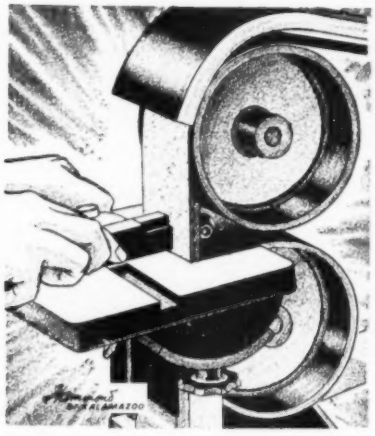
setup for a new product, it was the general manager and the superintendent, and occasionally a vice president, who attended the discussion. But Jessop never was invited to sit in, listen and ask questions, yet he had the responsibility of the operation and production of the tools that were bought. (3) The superintendent and chief engineer frequently went to see new setups for increasing production and reducing costs on similar work in other large factories, but the foreman was never invited to accompany them. (4) Whatever was learned on these trips was never passed along to Jessop other than a brief statement like, "Such and such a firm is making pieces similar to our No. 6K47 at a 20% faster rate than we are averaging." Details regarding and jigs and fixtures used were never mentioned, and, Jessop himself did not care to ask questions because it would promptly be indicated that he was supposed to know all this as part of his job.

The personnel manager promptly did something. He saw to it that Jessop was sent to all worthwhile exhibits with all expenses paid; the only provision made was a request that Jessop write up suggestions as to how his firm's product could be improved, or costs reduced, as a result of something he saw and learned on the trip. At first he only made a few suggestions, but after several trips he started spotting new methods and short cuts which were soon followed by requisitions for new and expensive machine tools and equipment with a detailed outline showing how costs could be cut and profits increased as a result of using the new machinery. Complete amortization figures were always included. That was three years ago.

Today Jessop is assistant manager in charge of production and is con-

"You wouldn't mind working a little over time tonight, would you, my friend?"

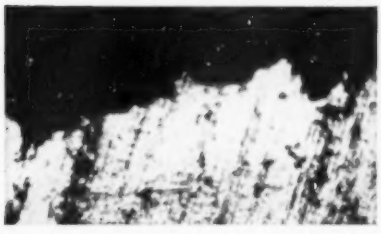
NEW 3M DISCOVERY obsoletes all other abrasive belt methods for sharpening carbide tools!



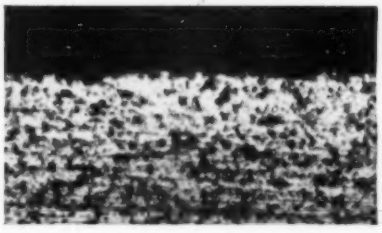
Here is a completely new machine—a completely new method—for belt sharpening tungsten carbide tools. Gives a longer-lasting, more precise edge than ever before possible without diamond wheels and highly skilled operators. Developed by 3M, designed and built by Hammond Machinery Builders, this machine uses a specially designed 3M Abrasive Belt passing over an absolutely flat carbide platen. This special work surface—hard as the tools you finish—enables you to finish *every* cutting surface. That means you can finish the all-important *top* of the tool, impossible with previous belt methods. All lands are restored to original *flat* planes—not hollow-ground.

Look! Micro-photographs* prove new 3M Carbide Tool Sharpening Method gives a better finish than ever before possible except on a diamond wheel!

*These photos, representing 1/100 of an inch, show the cutting edge of a single point tungsten carbide tool.



Grinding with green grit silicon carbide wheels leaves this rough jagged edge leading to premature breakdown of cutting edge—result short tool life, frequent reshaping, costly set-ups and loss of production efficiency.



Finished with 150 grit "Tri-M-ite" Resinite Paper Belt, after rough grinding with a 60 grit green wheel, gives this near-perfect edge. Even an unskilled operator can attain results like this! Compare this picture with the one at right . . .

. . . finished with 180 grit diamond wheel. Here is perfection—on a brand-new tool! These micro-photographs show the slight difference between the 3M-sharpened tool and this diamond-sharpened tool! Here is conclusive proof that the 3M Carbide Tool Sharpening Method comes as near perfection as it is possible to get—at only a few cents per belt!

GET ALL THE FACTS FROM YOUR 3M REPRESENTATIVE about this amazing new method for sharpening carbide tools. He will be glad to give you full details!

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MINNESOTA MINING & MFG. CO., Dept. AM-63, St. Paul 6, Minn.

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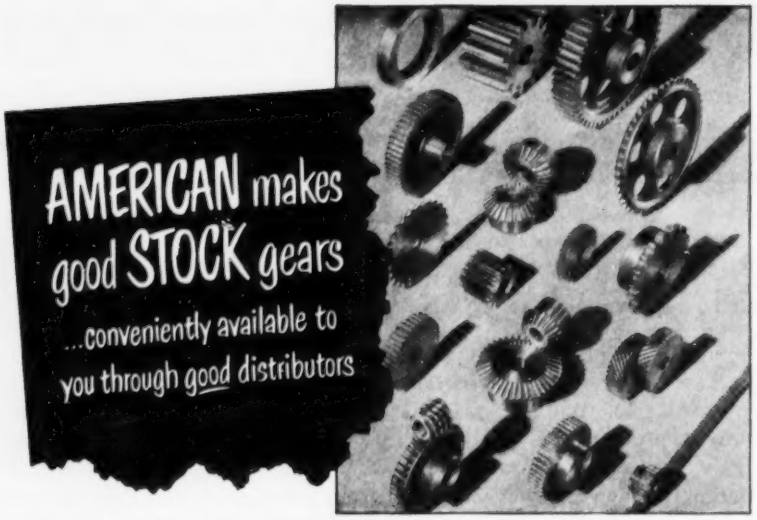

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sidered by the management as one of its key men. He had the brains and the ability all along, but he had never been encouraged or given the proper opportunity to use them until the personnel manager had insisted on him being treated as a trustworthy intelligent employee. I am afraid there are many other good foremen who are being held back by big shots who think that they, and only they, are competent to go to see and learn what other firms are doing and then never bother to pass any valuable information along in the usable shape.

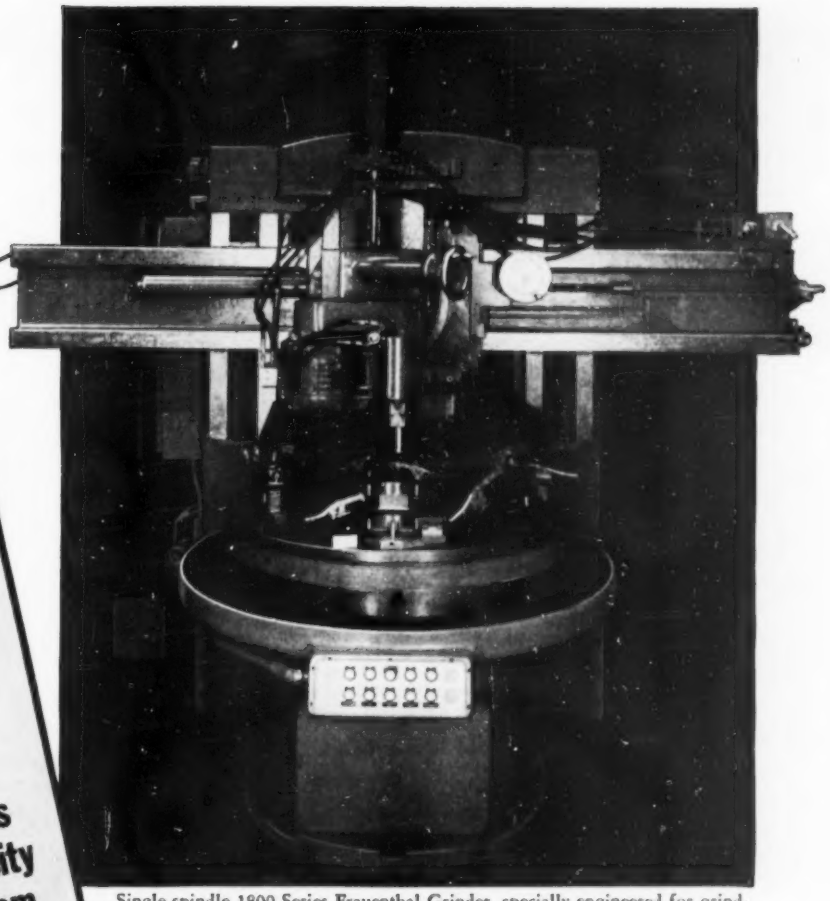
George P Pearce
Albuquerque, NM

•

THE INABILITY of persons to keep up with their jobs or the trend toward complacency regarding the job is nothing new. People are funny and many of them feel that once a job is mastered, from that day on everything stops and there can be no more advancements in their type of work. This kind of thinking seems to predominate among the lower echelon of supervisors and skilled workers. It is a factor which surrounds conditions such as are discussed by our two friends.

Whether an individual keeps up with the times on the job today, certainly influences his own chances for advancement. In this growing world of competition the only people that our companies can afford to have in management are those who know their work and keep up with the new trends—those people who are not afraid to study new methods and to try them. If the new ideas fail, then the individual must not become sour on all new things; rather

"... she loves me NOT!"



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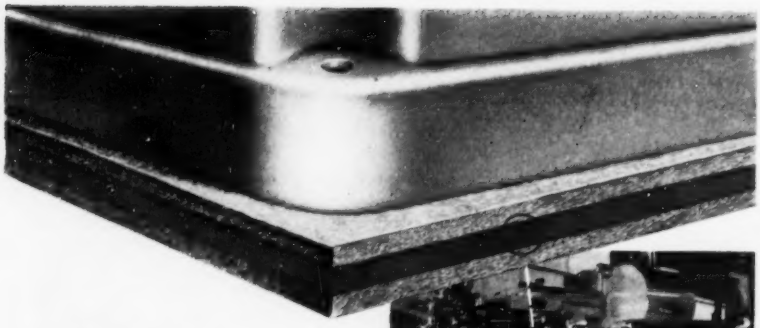

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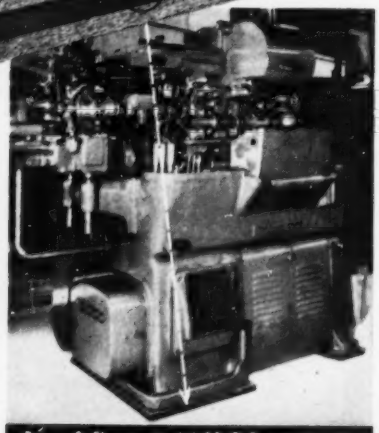

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he must be capable of knowing *why* they failed and to quickly make the necessary readjustments.

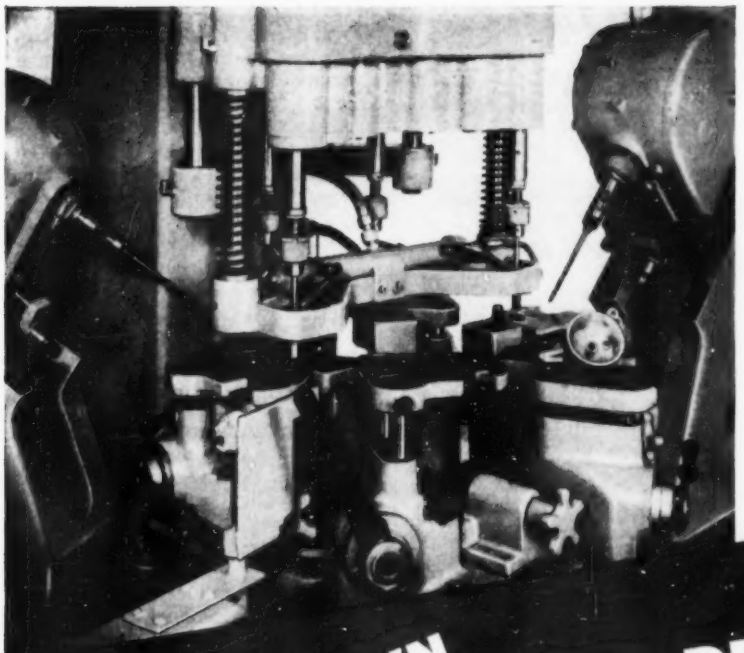
It is true that the mere trying out of new ideas can lead to failure. It requires good judgment and level thinking to weed out those crackpot ideas from the sound suggestions. This means that people must advance and grow with their jobs.

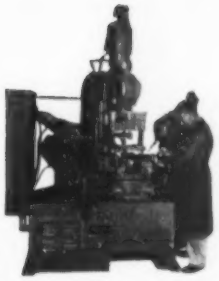
Should someone tell these people they are not keeping up? This is a definitely debatable matter. Yet, why should a company continually prod individuals into studying, or force them to adhere to rigid rules? We believe, in these United States, in freedom and we do not like dictatorship, nor are we interested in seeing industry dictate.

Programs should be made available to those persons who desire to take advantage of them and the educational values they offer. The company should strive to make these programs interesting and instructive. Interest should be created within the supervision of the company, but it is not entirely wise to force employees to take such courses. Outside pressures, such as non-advancement, can be used to make employees realize the situation. Naturally some people prefer to learn privately and will take courses on their own. Therefore, company-wide schooling can not be used to entirely judge the employees. It is performance that counts. It is how well the job is done and in how short a time.

What to do with those "old-timers" who stopped growing? There are at least two ways to handle this problem. First call the employee into the personnel office and lay the cards on the table. Find out why the employee has not progressed. Perhaps there are good reasons. It could well be that the employee is of value to the company because of his length of continued service and the data that he has stored in his head which is not available to others. Perhaps he can be used on other work that does

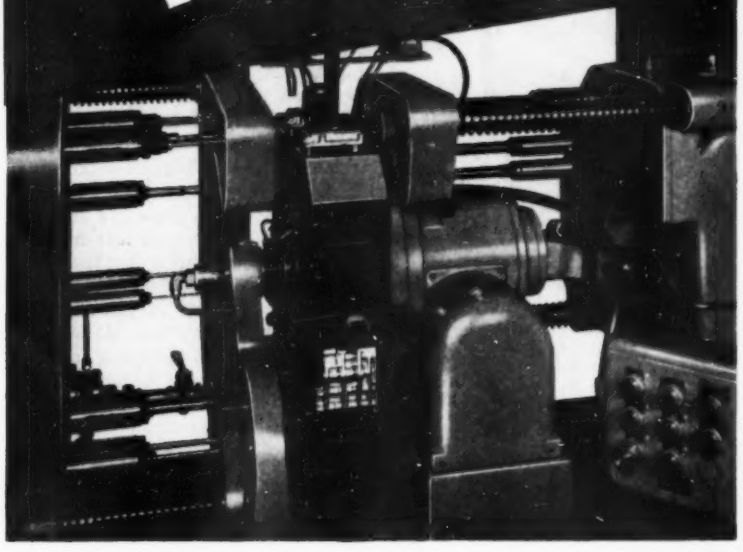
"—If I start quoting miscellaneous machinery estimates to you, it means the boss just walked in!"

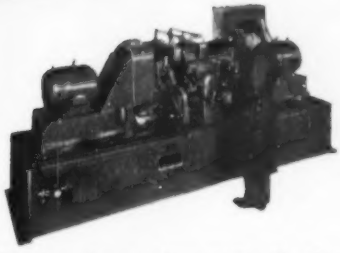




Closeup at the left shows a six station Hartford Automatic single purpose machine rough and finish reaming two cored holes, plus drilling two holes at different angles in die cast aluminum housings.

The LOWDOWN on HIGH PRODUCTION





This view shows a four station Hartford vertical dial type machine drilling, coredrilling and counterboring five holes in aluminum valve bodies.

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not require the advancement in methods and/or thinking. Maybe he can be frozen on his present work and someone who is more alert given charge.

All this leads up to the fact of retaining the employees at some level within the company. However, all advancements stop. The employee's pay would be frozen and possibly reduced. The company has an obligation to the other workers in seeing that such individuals do not get advancement in job titles and pay scales.

The second method of handling the situation is to coldly follow the pattern of the survival of the fittest. Each worker is on his own merits. If he or she does not live up to expectations, then the employee is let go. The policy seems drastic, but if the company adopts it, then when a new employee joins the organization, let him be advised of the policy and keep on the alert.

A good personnel department whose director is on his toes can do much to help prevent the above conditions from becoming an issue.

Charles D Townsend
West Hartford, Conn

•

THE CONSENSUS of ninety private employment agencies of New York City, reports that anybody over forty looking for a job had better take stock of himself to make certain that he isn't his own biggest stumbling block.

When I read this account I thought of old Burke who had lost his job with the Apex outfit because the new manager was of the opinion that he had outlived his usefulness as a foreman. It may be that Burke suffers from the disintegrating inroads of old age unknown to himself but very obvious to others.

We cannot say with our old friend Mac that old foremen never die and that they just keep shoving along. Foremen do die, mentally, just like anybody else. Foremen get fed up with it all and take the easy route throughout the day just the same as a dishwasher does, unless he is fired with that mysterious thing which drives him on to further effort. Some pass out slowly—that is, the monotony of the job seems to infuse their bloodstream with some sort of a hookworm—while others develop a hot box all of a sudden to stall the smooth-running train of production. Many go along with a full head of steam until they drop in their tracks with a heart attack, while others, for some unaccountable reason, reach

the critical stage where they are unable to function with marked zest in absorbing new ideas.

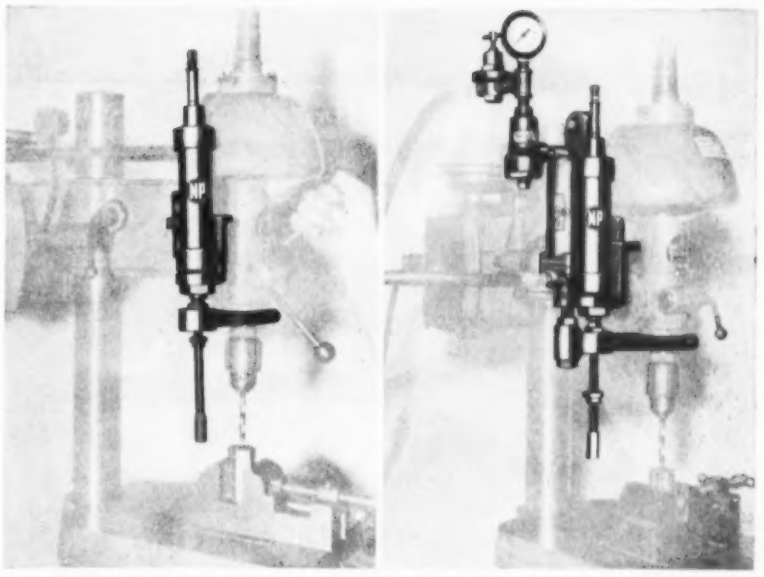
We have the rare individual whose mind is so set in its ways that no amount of reasoning can change it. This type is like a machine in that its capacity is limited, and when an attempt is made to overload it, there is trouble in store. We've got to consider the individual in the light of his capacity to take it, but unfortunately we cannot detect this until it is too late.

We can look at a machine and determine pretty closely what the machine can take. We cannot do this with one of these two-legged phenomenons who invariably start out like a house afire and then crumble into inactivity later on. Somewhere along the line he reaches the point where his EMF gets too weak to overcome the resistance, then his effectiveness as an executive diminishes accordingly.

Whenever this takes place it presents a problem as to what to do. Burke may have been conscientious on the job in every way but failed to see why he should be replaced by another. He had grown with his department up to a certain degree, then trailed along, unable to keep pace. Either pride or bull-headedness caused his failure to admit that he had fallen down on the job.

It is not for the foreman to determine his fitness or unfitness—that's the job for the man who is responsible for the output—the manager. The manager could be wrong, but the chances are that his judgment, in most cases, is sound. If Burke isn't up to his highest, or if he makes it evident to the manager that he isn't capable of the highest performance, the facts should be brought to light at a conference between him and the manager or his immediate superior. If the foreman can face the truth, which should be

"Wants to know if he can switch to a left-handed machine to even things up."



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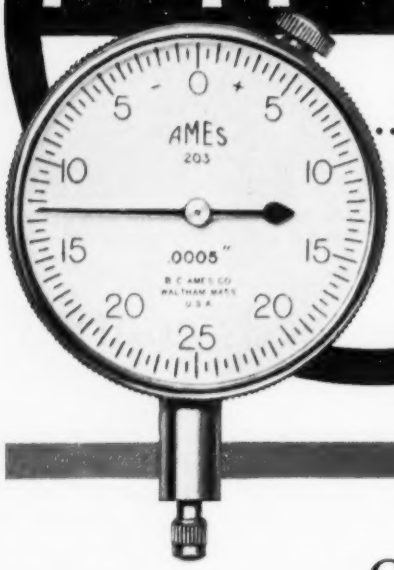

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revealed at this conference, he should resign himself to the inevitable and do one of two things: submit himself to the mercies of the court and step down, or else consider his job with the firm at an end. Burke's pride seems to have been responsible for his leaving the company altogether.

What do we do when we find that a machine has become outworn through years of rugged service? We tear it down and give it an overhauling. Unfortunately we cannot do this with a foreman who has become worn at the heels, mentally—and who is not alert to progressive methods. He has torn himself down by his apathy, so out of the wreck we can proceed as follows: plane the ridges and worn spots from his "ways" of thinking, scrape the unprogressive methods from his bearings, and realign his crumbling judgment by giving him a leave of absence, with pay, so that he can acquire new ideas and appraise himself in comparison with contact with the progressive world outside. He does not necessarily need to walk a sawdust trail in order to become converted to the ways and means of modern thought, up-to-date procedures, and efficient equipment.

If the foreman has been conscientious on the job and modern production methods seem to be too much for him to take, he is entitled to every consideration and should be given the chance to come back through outside review. His loyalty to the firm should be rewarded in some way so that he may be shown that his services were not all in vain. The cost of his resurrection by outside study is only a drop in the bucket compared with the benefits to the firm that will ensue.

A survey was made by the New York Joint Legislative Committee on

"—and just why are you so confident you would make us a good inspector?"

To procure gears that would meet the most exacting specifications of quality materials and precision cutting and finishing required for this new artillery piece, the U. S. Army came to Philadelphia. With our many years of specialized gear manufacturing experience plus our modern equipment we filled that need. We are proud of our part in producing for America this first ground weapon capable of firing conventional and atomic shells.

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Die Steels—Hot Work and Shock Resisting Steels
Carbon Tool Steels.

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For Years of Trouble Free Service
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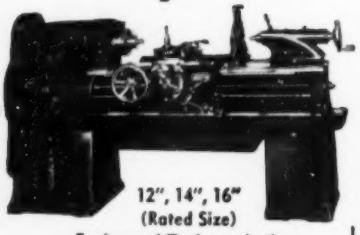
Metalmaster LATHES



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(Rated Size)
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POWER for Your Job: 2 HP to 10 HP

SPEEDS for Your Job: 16 RPM min. to 1000 RPM max.

FEED: 72—.00072 to .1780

THREAD RANGE: 1½ to 368, including 11½ and 27 without extra gearing

• Let our Engineers solve your lathe problems.
Write for Bulletin 179

THE BRADFORD MACHINE TOOL CO.
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Precision Since 1840

DELIVERIES:
30 days, subject to prior sale

problems of the ageing as part of the many years' of effort to aid the forty-plus jobseekers in their quest for work. Why should we wait until a man is looking for a job before we do something toward his interest? Why not devote some study to his present activities while on the job so that he may take steps to remedy his deficiencies before he becomes a derelict? Why not have a committee appointed in each plant to look into the qualifications of its executives periodically so that they may flood them with the light of approval or disapproval.

Treat your foremen as you treat your equipment—give them a periodic checkup now and then so as to strengthen them where they appear to be falling down on the job. Be tactful in your dealing with them and remember that they are human beings at heart, possessing pride and self respect. Don't crush them with unfair decisions and you'll find that with consideration and kindly advice they'll make good. Give them a shot of powerful vitamin x-y-z occasionally, accompanied by a sound slap on the back, and you'll find that you'll have a valuable asset to your outfit.

John Homewood
Ontario, Calif

•

NOT-SO-SWEET CHARITY

How should fund raising be handled in the shop? Should each individual be assessed a specific amount, or is it fairer to leave it up to the man as to how much he should or can contribute? Who should be responsible for quotas or collections?

I DON'T BELIEVE there is any need for having an unofficial fund where everyone has to pay a fixed or variable amount for one week or a month so that some guy may be selected to dole out cash for flowers and gifts. In the first place it's wrong to demand money for such purposes, and secondly, if such money is raised, all contributions must be optional.

I have no objection to official welfare funds; it's necessary in countries where it is not handled through the government—often the case in Europe. However, to deduct 10% of one week's pay or 1% of a month's salary would certainly create a lot of objections; it would not be fair to everyone concerned because some of the fellows, and executives too, have enough on their own to pay for.

I think Al's suspicion that the

boss would base his estimate of how good a foreman he is on the amount he collected is unfounded; no sensible boss would do that. A foreman should never be held responsible for charity quotas in his department. The best way to raise funds for worthy causes is through an official community fund drive.

Al's unofficial welfare ideas might be suitable in some particular shop, but making such a contribution compulsory does not fit democratic principles and free men.

A E Fristedt
Stockholm-Bromma, Sweden

•

NO ONE PERSON can know all the answers to all of the problems that crop up in day-to-day operation of a machine or tool shop; anyone who assumes that he alone does or should know all the answers is just downright stupid. Yet we know that there is an answer to every problem—all we need to do is find it.

Finding or seeking out answers is part of the job of supervision and leadership. If a man whose responsibility it is to get things done is unwilling to let it be known that he has problems to solve, he can't blame anyone but himself if no one will help him to find the answers.

The ability to recognize and apply right answers, from whatever source, will quickly identify a foreman as having more practical knowledge than if he presumes to be a walking encyclopedia. Of course good sense should be used in seeking answers from reliable sources.

A good foreman is not expected to know all of the answers. If he is

"I see we have three Jones in this department."

This **award** *proves what we've been saying...*

...Liquamatte

simplifies wet blasting

and cuts precision finishing costs

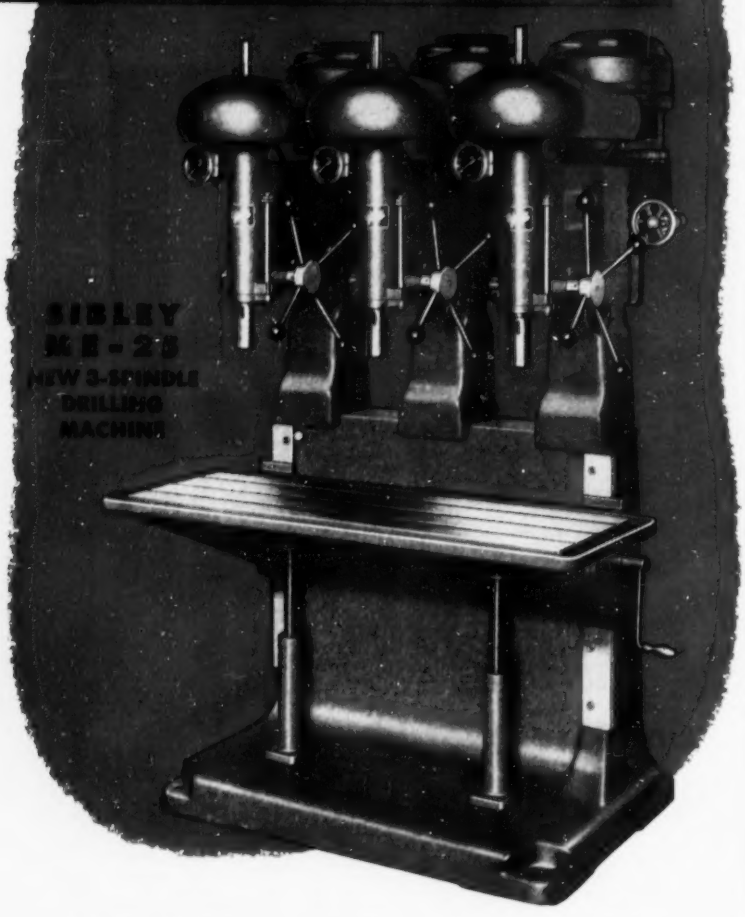
For some time now, we've been telling you about Liquamatte's 14 advanced design features that cut costs in finishing molds, dies and precision tools. We've tried to show you how the Liquamatte simplified the wet blasting process and eliminated complicated mechanisms. Now, this award for "excellence in general mechanical design" from the editorial staff of Design News Magazine substantiates these claims.

Further proof of the results obtained with a Liquamatte is the installation at the Oling Tool Company. Here, the Liquamatte is saving an average of 50% on former time and labor requirements for surfacing tools prior to plating. On some items such as drill bits, savings as high as 80% have been effected.

The 14 advanced design features of the Liquamatte can cut your costs too. *Bulletin 43 tells how. Send today for your copy.*

American LIQUAMATTE WET BLASTING
WHEELABRATOR & EQUIPMENT CORP.
317 S. Byrkit St., Mishawaka, Indiana

Cut Work Handling



Work-handling consumes more time than work-cutting in producing many jobs. Reducing manual effort by one-half may increase production more than by faster cutting speeds. To make this improvement without burdening the operator —in fact to make it easier for him—is the chief advantage of the new Sibley Model ME-25.

The variable speed drive, the big 21½" swing, the extra large table, the convenient speed controls, the handy tachometers, all combine to make this 1" capacity, medium weight machine a production advantage in any shop!

SIBLEY

MACHINE & FOUNDRY CORP.
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SIBLEY MACHINE & FOUNDRY CORP.
Dept. AM-6, South Bend 23, Indiana
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wise enough to put the right man on the right job at the right time, he will prove his ability to get things done. That is all that should be expected of him.

Henry George
Dayton, Ohio

•

EMPLOYEES HAVE more respect for a foreman who shares his responsibilities than the one who stands off as an infallible know-it-all. When the employee knows that his superior is open to suggestions, he will not hesitate to offer them. Many men will know the answer to a difficult problem in the shop, but will keep it to themselves because the leader does not appreciate help from the men. Some foremen will not accept the theory that "two heads are better than one, even if one is a cabbage."

A worker one day told me how he enjoyed watching the foreman sweat for two hours trying to get a machine to run with the switch in the off position. The worker knew the switch was off, but waited for the foreman to find out for himself. If the foreman had asked for advice, the worker would probably have told him about the switch.

In most shops, the workers match wits with the foreman to display their knowledge. If the foreman is cooperative, he will gain the respect he deserves, as well as constructive experience. On the other hand, the foreman is constantly at the mercy of the kibitzers. These fellows are quick to offer engineering advice at every opportunity. Most of their suggestions are wild guesses or shots in the dark. It is the foreman's task to weigh each contribution and determine which seems most practical.

"Now don't give me some song and dance . . . I want to know why production in this shop is falling off!"

half the time with Heller NUCUT wavy teeth

Coarse, fine and extra-fine teeth all combined on one file for fast, deep, double-action cutting. Even, scratch-free finish. No chattering. Longer file life. **ORDER FROM YOUR LOCAL DISTRIBUTOR**

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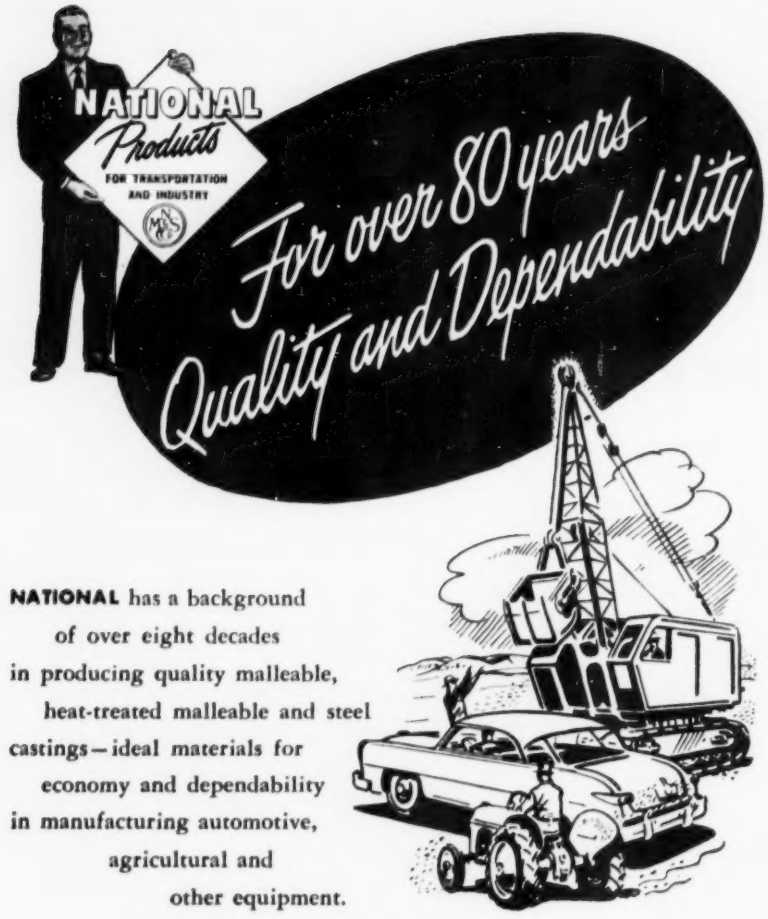

NATIONAL has a background of over eight decades in producing quality malleable, heat-treated malleable and steel castings—ideal materials for economy and dependability in manufacturing automotive, agricultural and other equipment.

NATIONAL'S unparalleled experience—coupled with a continuing metallurgical research program, rigorous quality control standards, and completely mechanized foundries in strategically located cities—is at your disposal.

Sales offices and engineering facilities are located at all five plants listed below.

A 16mm Technicolor film. Narrated by Edwin C. Hill, this 27-minute film tells how malleable iron is made . . . tested . . . used . . . how its production economy, ductility, machinability, toughness will give you a better finished product. Available for group showings. A-5017

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NATIONAL Products FOR TRANSPORTATION AND INDUSTRY Est. 1868

If the foreman has a plan of approach, he should not let the sidewalk superintendents divert his attack or lead him into blind alleys. Any reasonable advice should be investigated before it is discarded. If the foreman is not acquainted with the machine or the operation, he should discuss the problem with the operator and ask his opinion. The foreman doesn't have to take any advice offered, but at least there is no harm in letting each man voice his ideas.

Engineers are strange creatures in this respect. They don't want any advice. They feel that they know what they are doing and don't like to have anyone tell them what to do. Even if they are wrong, they like to know what will happen if the machine is set up a certain way. Many discoveries have been the result of someone doing something wrong or in an unorthodox manner. A foreman should realize that he is only a leader and is placed in authority to guide the men in their tasks. He is adopting the wrong procedure if he feels that he is a genius, or must give his men that impression.

Many foremen who know the answers will ask the workers for their opinions to check their faculties. Nothing inflates a worker's ego more than to have the foreman ask him his opinion on a current problem.

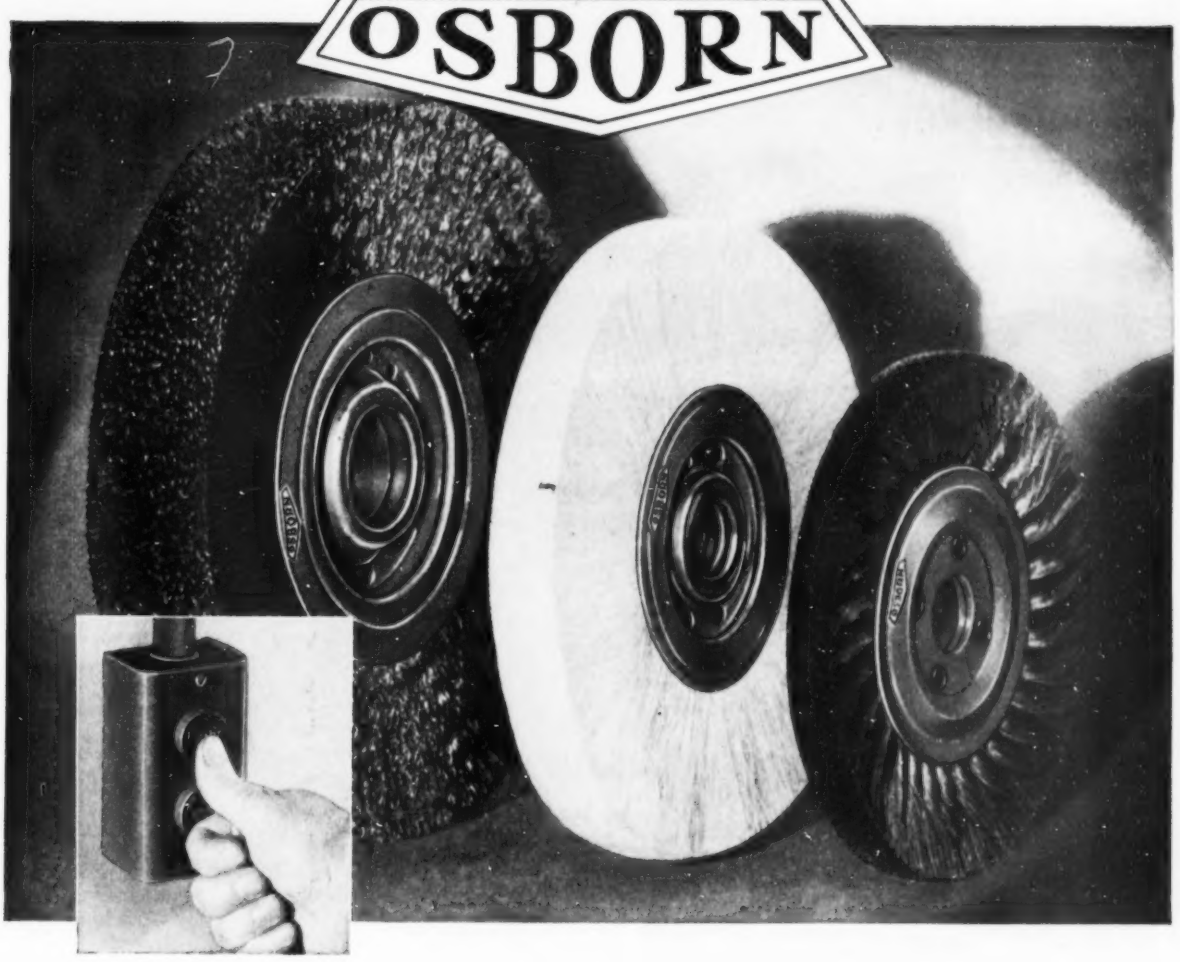
Frank J Zarnowski
Rutherford, NJ

•

THE FOREMAN WHO feels he must always be right in order to hold his job or the respect of his men must spend a lot of time at home where he can duck the tough ones, or else

"Can't you file your nails at home? You make me nervous!"

OSBORN

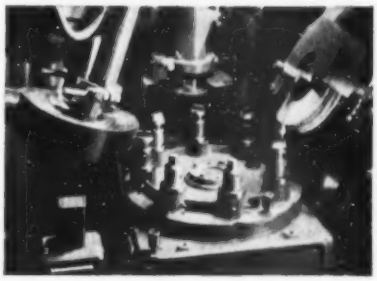


try this team for lower costs

Push-button brushing methods do jobs *better* and many times faster than by hand. For example:

Machine-powered Osborn Brushes are deburring parts 4 to 10 times as fast as hand methods. They are giving similar mass production benefits in cleaning and finishing operations of all kinds. Results are of uniform high quality. Rejects are practically nil.

Whether your product is metal, rubber, plastic or other material, ask to have an **O**sborn **B**rushing **A**nalyst study your operations to suggest improvements with the latest Osborn power brushing techniques. Call or write *The Osborn Manufacturing Company, Dept. C-6, 5401 Hamilton Avenue, Cleveland 14, Ohio.*



HERE, three different types of Osborn brushes team up to boost deburring output of small parts 300% and to produce smoother, more uniform results.

Osborn Brushes

OSBORN POWER, MAINTENANCE AND PAINT BRUSHES AND FOUNDRY MOLDING MACHINES

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Delicate "buried" adjustment or extra-heavy duty service . . . no job is too tough for the right Williams' "Supersocket"® There's a complete selection of patterns, sizes and sets . . . drivers and handles . . . ratchets, speeders and flex handles . . . adapters, attachments and extensions. Correctly designed and accurately made from selected alloy steel, heat-treated and chrome-plated.

Be wise . . . Buy WILLIAMS INDUSTRIAL TOOLS

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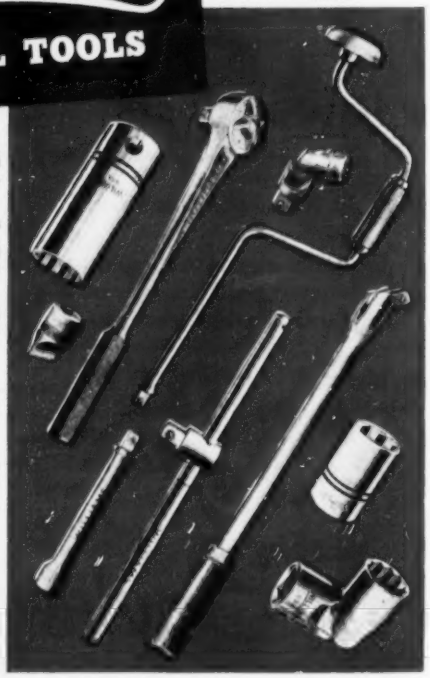


1/4" square drive features thin, strong, straight wall sockets unequalled in cramped quarters for delicate adjustments on radios, electronic assemblies, etc.

3/8" square drive gets in and services "buried" nuts in close, awkward corners. Universal and extra-deep sockets and crowfoot attachments are included in this pattern as well as others.

1/2" square drive in regular sockets and specialized designs for servicing spark plugs, U Bolts, etc. Thin walls and durability are outstanding features.

3/4" square drive provides strength without bulk. 12-point socket openings rotate nuts where handle can swing only 30°. Regular and extra-deep designs.

1" square drive "Extra-Heavy Duty" stands up under hardest service. Sockets are cross-drilled to receive sliding handle. "Lock-Socket" device provides positive lock and simple release.

The Complete Williams' line, the broadest line of its kind, is illustrated and described in Catalog 301. Can we send you a copy?

J. H. WILLIAMS & CO., 538 Vulcan Street, Buffalo 7, N. Y.

must be in possession of a crystal ball that really works, because sooner or later the average foreman learns he doesn't know all the answers. In fact, I would say that being 90% right most of the time is a pretty good batting average for any executive.

So, friend Ed would be doing the smart thing if he accepted the facts of life and got down from the pedestal he thinks being a foreman entitles him to, and ate a little humble pie. Because somewhere in his organization there may be someone who knows the answer to the problem that is worrying him—not because he happens to be smarter than the boss—but because somewhere along the line this man's experience has involved the type of press tool that is causing Ed trouble. Sometimes a man may know the answer to such a problem and be hesitant about stepping forward, not knowing how the man in charge will react to being told.

However, if a foreman is big enough to get the men together and tell them he is open for suggestions, there is no doubt in my mind as to how they will react. Out of the pooled reservoir of their experience, someone will come up with the right answer.

Unfortunately, however, there are still individuals like Ed who would rather muddle through on their own than lose face by admitting that their experience hasn't included this particular type of problem. Besides losing money for the company, they lay themselves open to more criticism from the men than if they had been big enough in the first place to ask for suggestions. Not only that—their foolish attempts to protect

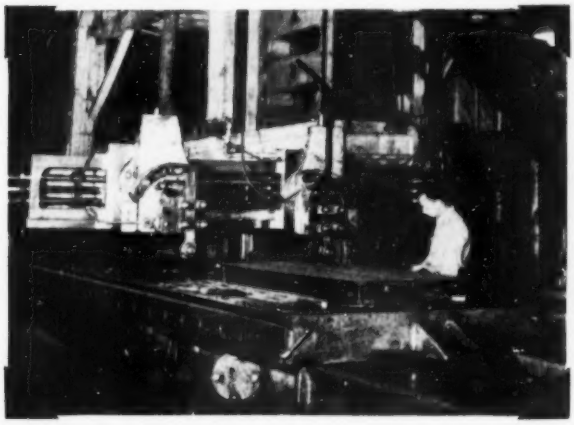
"Mr. Newman was in such a hurry this morning he—"

STANDARD ENGINEER'S REPORT

DATA

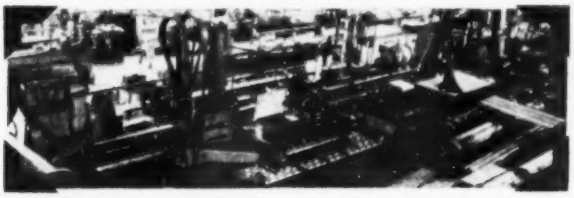
LUBRICANT	Calol Vistac Oil
UNIT	72" open-side planer
OPERATION	Machining heavy-duty metal parts
CONDITIONS	Extreme pressures
PERIOD	4 years
FIRM	Lamb-Grays Harbor Co., Hoquiam, Wash.

Tacky oil on planer ways assures precision work!



WHEN CALOL VISTAC OIL replaced another lubricant on the main ways of this 72" open-side planer, its constant, even film helped to assure truer cuts for the Lamb-Grays Harbor Co., Hoquiam, Wash. Previous oils used by the company had gummed quickly, left deposits on ways, and seriously affected precision.

THE PRESSURE-RESISTANT FILM of Calol Vistac Oil stays on the ways even under extreme loads. For example, when work weighing up to 7½ tons was carried on the 10-ton bed of this planer, the "high-oiliness" film did not squeeze off, despite the 17½ ton load.



"NO TROUBLE OF ANY KIND" is the report from Lamb-Grays Harbor Co. since they changed to Calol Vistac Oil in 1948. Calol Vistac Oil is also used in reduction gears, motor heads, air-tools, and heavy-duty plain bearings. It comes in several grades and may be applied by wick-, ring-, or drip-feed oilers.

FREE CATALOG: "How to Save Money on Equipment Operation," a new booklet full of valuable information, is ready for you. Write or ask for your free copy today.

CALOL

How Calol Vistac Oil Cuts Costs on Metal-Machining Equipment

On machine ways, in hoist gear sets, motor gear-heads, air hammers, heavy-duty plain bearings—stays put and saves wear because of viscous, tacky nature. Atomizes quickly and stays fluid at low temperatures.

A. Special additives help form oily, pressure-resistant lubricating film...won't run off slow-moving parts.

B. Economical—small quantity will lubricate efficiently, dissipate heat.

C. Tenacious film cuts power loss and wear.

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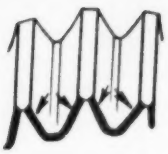
Model 2029 BURR-MASTERS for chamfering and burring flywheel ring gears.

CHAMFER and BURR up to 20 TEETH PER SECOND!

***Burr-Master*° completes 156-tooth flywheel ring gear in 12 seconds**



Type of chamfer produced on 20 flywheel ring gear teeth per second.

BURR-MASTERS have revolutionized the burring and chamfering of all gears and splines. Cleanly chamfering and removing burrs from the teeth of 240 flywheel ring gears per hour is something you can expect only from a BURR-MASTER.

Gears are loaded and unloaded without stopping the BURR-MASTER. The unskilled operator merely places the gear on the spindle. The rest is automatic. Cycle indicator light tells when the gear is finished.

Ask for Bulletin 103-50

MODERN *Industrial Engineering Co.*

°Reg. Patents applied for

14230 BIRWOOD AVE
DETROIT 4, MICH.

their precious ego will sooner or later attract the attention of the higher-ups. It only takes a few production tie-ups like the case under discussion to start the top brass wondering if they have the right man doing the supervising.

I agree with Al; the average man likes to think he is working with a human being, an individual who makes mistakes and is man enough to acknowledge them and appreciate any offer of assistance no matter from whence it comes. Such a man is more likely to win the respect and loyalty of the people who work with him than the individual who tries to create the impression that he and he alone is capable of dealing with any situation that calls for more than average know-how. The natural human reaction to a person of this type is to hope that we are around when Mr Know-it-all falls flat on his face—and sooner or later, it happens.

So, Ed, forget about the "ivory tower" and get out and mingle with the common people; even Presidents have been known to do so when confronted with problems infinitely greater than those of a machine-shop foreman.

Robert S Alexander
Greenville, RI

•

JUNGLE LAW

How much responsibility has a foreman toward his company in the matter of lining up and training a successor, particularly if he is considering leaving the firm eventually?

CAN A COMPANY demand loyalty of its foremen? The answer depends on how the company treats its foremen. If the firm gives them good wages, pays them when they are sick, treats them as part of management, consults them in changes of policy, then a foreman would not have to look for other opportunities; he would know that he'd be taken care of at any time.

On the other hand, if an opportunity for advancement presents itself, the foreman should go to the head of the company and lay the cards on the table; the firm would not be against the advancement, even though in another organization, and plans could be worked out to the advantage of all.

As to the question of Ed providing someone to take his place—that varies with company policy. In some organizations, no foreman can pick his successor; the head of the com-

pany does that. In other firms policy is that the foreman should have an assistant to help him with his work and to take charge when he is away. Then it is up to the foreman to pick the right man to help him, a man he can get along with.

If Al is working for such a company, then he should by all means go to the head of the concern and tell him what he has in mind. It may be that if he is a good man they would advance him instead of letting him go. If they can't do that, they could arrange to have the right man to replace him when he left.

If company policy is to have a foreman only a man between top management and the shop men, the company does not care much for the foreman. Why shouldn't he then, if he has an opportunity for advancement, take it?

In most cases, however, the foreman should act like a man, and notify the company of his intention so that replacement arrangements can be made. We still are a free country; if a man does not like the place where he works, he can always quit; no one will stop him.

Michael Axler
Los Angeles, Calif

•

WHEN A COMPANY wants to get rid of one of the employees they do not tell him they are thinking about it —they just get rid of him. Sometimes they give him two days' notice, sometimes a week, two weeks, but very seldom a full month. So why should the employee tell the company that he is thinking of quitting?

In this case, the employee is going to give the company a month's notice, which should give them ample time to replace him. Regardless of the employee's status with the firm, he has the right to be enterprising. He should not be expected to tell the company he is thinking of leaving.

Perfected at Last!

Johnson

ALUMINUM-ON-STEEL SLEEVE BEARINGS

Are you one of the engineers who have been searching for a bearing metal with higher strength, higher load capacity and resistance to high engine temperatures? Improvements in machine design to reduce unit cost or improve efficiency often require greater loads on the bearings. Now you may design to use sleeve bearings with properties never available before.

These roll-bonded Aluminum-on-Steel Bearings may be used for loads up to 4000 P.S.I., yet have good conformability, good resistance to shaft wear, good resistance to corrosion, adequate seizure resistance and good resistance to fatigue. Tests prove that the bond to the steel back is as strong as the metal itself. These properties make Johnson Aluminum-on-Steel Bearings new high-load, high-speed bearings with a great future for high-load internal combustion engines.

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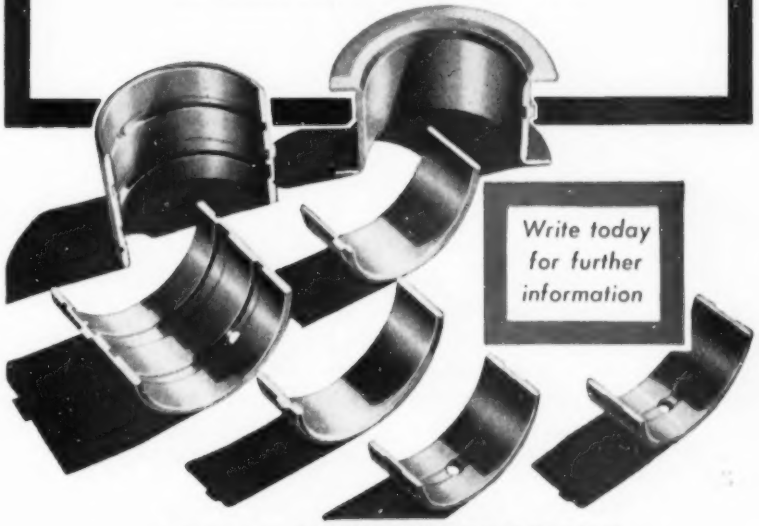

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JOHNSON BRONZE PRODUCES ALL TYPES OF SLEEVE BEARINGS: BRONZE-ON-STEEL, copper lead • STEEL BACK, Babbitt Lined • BRONZE BACK, babbitt lined • CAST BRONZE, plain or graphited • SHEET BRONZE, plain or graphited CAST ALUMINUM ALLOY • LEDALOYL powder metallurgy

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JAWS NICKEL CHROME MOLY ALLOY STEEL . . . expertly heat treated for durability
KEY HOLES— do not extend into body cavity thereby sealing out dirt
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quality chuck...

The makers of Supreme brand Chucks are experienced manufacturers of precision mechanical assemblies with an enviable reputation for skill and craftsmanship. This know-how plus the most modern manufacturing equipment gives a chuck that can truthfully be called a quality product. The Supreme Chuck is engineered to give accurate precise performance and stand up under hard steady usage on the job.

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Supreme Products, Inc., 2222 South Calumet Avenue, Chicago, Illinois

THE CHUCK THAT LIVES UP TO ITS NAME . . . SUPREME

as long as he does give them sufficient notice when he decides.

When the employee has given his notice, it is his duty to suggest or recommend his replacement. He should help the replacement in every way he can and not hold anything back, even though he is planning to join a competitor company.

In the case under discussion, the employee who has another job in view admits he has been treated with consideration at his present place of employment. He has a good record with the firm, and he should make every effort to maintain that record right up to the last day.

Hard work, loyalty, and an honest attitude is the secret of success. Some people think you have to be clever, but this follows and develops after the other three qualities. If we are loyal, people help us; if we are honest, they respect us. When we work hard at any job, we are bound to become clever at it. In my opinion, we lose little, and gain much by helping the other fellow.

Albert E Salmons
Philadelphia, Pa

•

A MAN SHOULD be decent and fair no matter if he does feel that he has been ill-treated. Just because some higher executive has snapped at him some morning, or refused him a salary increase, is no reason for him to lower himself to the jungle level and start thinking about getting even and taking an "I'll show 'em" attitude.

Today the management of almost all companies, and particularly the successful ones, is strictly honest, and composed of earnest men. They

"Joe, pick up my lunchbox in B-3 on your next trip."

Efficient Stripping of Rejected Painted Parts

When the volume of painting rejects slows down your rate of production—as may occur in the manufacture of rigorously-inspected defense equipment—it is time to plan an efficient method for stripping the faulty coatings.

The rejected parts represent a considerable investment in the cost of metal and the cost of fabrication. To hide 5% of your total production in a corner is like hiding 5% of your working capital in a sock. The quicker you reclaim those rejects and push them through as accepted parts, the better profit you make on your contract.

Sometimes the time element dictates more efficient stripping. Suppose that a sub-contractor undertakes to produce 100,000 parts in 20 days. Suppose also that he averages 5% rejects and that he lets them pile up until he has 5,000 to strip and re-process on the 20th day.

On that day he discovers with sorrow that it is a lot harder to strip and repaint 5,000 rejected parts than it was to paint his regular daily quota of 5,000 new parts. He misses his deadline and suffers embarrassment that could have been avoided by stripping 250 rejects each day for 20 days instead of 5,000 in one day.

Furthermore, it usually is much easier to strip the parts on the day they are rejected. Even though the parts were thoroughly baked in the ovens, it is still true that the longer the paint ages on the metal the harder it is to remove by any method of stripping.

Another point is that the easy method of dumping the rejects into an out-of-the-way tank for overnight soaking frequently is not the best way to strip the paint. Some paints cannot be removed by immersion in any one stripper, be it alkaline or acid or solvent. Yet many such paints respond quite readily to the right combination of two of these strippers.

The technique of rinsing is also important. Some paints yield only to a hot alkaline stripper followed by a hot rinse. Sometimes a cold rinse following a hot immersion seems to provide a shock that removes the paint with great speed.

The economy of finding the best stripping method is so great that it merits careful planning. It may also require the advice of a man who has had plenty of experience with all types of stripping operations. Such a man is the Oakite Technical Service Representative in your city.

The Oakite Representative has a broad array of stripping materials at his command:

- Oakite Stripper, Oakite Stripper M-3, Oakite Stripper R-6, Oakite Composition No. 45 and Oakite Composition No. 60 are alkaline materials that work with great speed and efficiency, whether used for reclaiming rejects from the painting line or for stripping conveyor chains, racks and hooks. These materials also are excellent for "killing" the oversprayed paint in water-wash booths.
- Oakite Test X is another alkaline material capable of removing many types of paint.
- Oakite Composition No. 17 (solvent) and Oakite Composition No. 64 (alkaline) are especially designed for safe stripping of zinc chromate primer from aluminum.
- Oakite Composition No. 15, Oakite Composition No. 15A, Oakite Composition No. 18 and Oakite Composition No. 56 are solvent strippers of great effectiveness, particularly on the newer types of synthetic enamels.
- Oakite Composition No. 57 is a viscous solvent stripper that has special value for its ability to adhere to vertical and inverted surfaces.
- Oakite Compound No. 33 is an acidic material that simultaneously removes oil and rust in addition to stripping certain types of organic finishes.

For more information on this subject, phone your local Oakite Technical Service Representative or mail the coupon at the right.

Advertisement

DO REJECTS SLOW UP YOUR PRODUCTION LINE?

OAKITE PAINT STRIPPERS MAY HELP YOU BREAK THE BOTTLE'S NECK

When the volume of painting rejects slows down your rate of production—you may need one of the stripping materials described in Oakite's free booklet "How to STRIP PAINT." This compact illustrated booklet answers many questions that will help you work out better stripping procedures. As a metal processor you will be particularly interested in:

- **What's the best way to strip paint from metal parts too large to be soaked in tanks? *See page 3.***
- **What is the cheapest way to strip metal parts in large volume? *See page 9.***
- **What are the best ways to prepare stripped surfaces for repainting? *See page 11.***
- **What strippers are best for removing oil-base paints?... Synthetic enamels, alkali-resistant plastics or resin-based paints?... Japans, wrinkle finishes, nitrocellulose lacquers, alkyds, phenolics and ureas? *See page 12.***

FREE For a copy of *"How to STRIP PAINT"* and for advice on your particular paint-stripping problem, just send us the coupon.

Technical Service Representatives Located in Principal Cities of United States and Canada

SPECIALIZED INDUSTRIAL CLEANING
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MATERIALS • METHODS • SERVICE

OAKITE PRODUCTS, INC.
24 Rector Street, New York 6, N. Y.

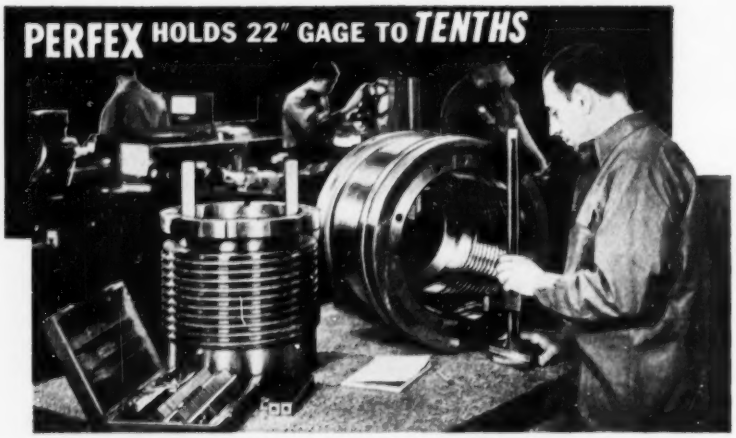
Send me a FREE copy of your booklet *"How to STRIP PAINT."* Also, tell me about your methods for removing the following organic finishes:

Name

Company

Address

PERFEX HOLDS 22" GAGE TO *TENTHS*



Of course, only one shop in a thousand needs these giant gages—but only one in a thousand has the experience and equipment for handling such precision. That's why Perfex is a better source for *all* your gage needs in thread rings and thread plugs, as well as specials. We still make 24 to 48 hour shipments on *most* standard thread plugs, from 0-80 NF to 1½"—6 NC, class 2 and 3. Our facilities include the finest grinding and checking equipment, operated under controlled temperature conditions, by a constantly growing force of the country's highest-skilled gage-makers. We're proud to offer you a superior product and service to match. Please write for copy of our new catalog and name of the Perfex representative near you.

Perfex also manufactures Tangi-Matic, the angle-tangent-to-radius dresser that eliminates height gages and "mikes"

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PERFEX GAGE & TOOL CO.

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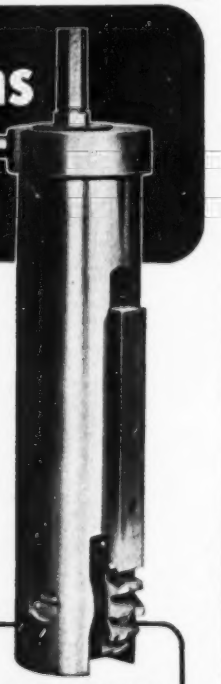
10 Good Reasons

why YOU should use NATIONAL Keyseating Millers on your next job



They will mill keyseats:

- in one cut.
- in offset holes.
- that are straight.
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- partly through holes.
- for interchangeable parts.
- without clamping the work.
- of standard width and depth.
- in holes that are closed at one end.
- where keyseating machine can't reach.

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WRITE TODAY
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complete, handy size

need all the business acumen and judgment they possess in order to operate the business in such a manner that they can earn a profit after taxes, payroll, expenses, obsolescence, maintenance, and reserve have all been deducted from the total income. If they cannot do this they are either fired, the same as anyone else who proves incompetent, or, as a result, the entire business goes bankrupt, and everyone gets fired. With this grim possibility in view it is quite obvious that they are not likely to go around getting rid of their best and most reliable men, the very men they depend upon to make their management a success.

The foreman who runs his department efficiently, who never has his men standing around waiting for stock or for instructions, who knows who he can install as a substitute for any man in his department who may, without warning, be off on sick leave, or meet with an accident, who has trained a couple of his smartest men to take over his studies in an emergency; that type of far-seeing, deep-planning foreman is about the last man any sane manager would think of letting go.

Of course, there are also those foremen who unfortunately have been hired by some company who doesn't appreciate a good man when it has him, and fail to pay him his worth, but even in this case it would be poor judgment for the foreman to let himself deteriorate to a low level to get even. The better way woud be to increase the efficiency of his department as much as possible so he would be trained and up to the second on departmental management; then he could look around for a better paying position.

In applying for a position, if it is stated that the application is confidential, I have never known of a responsible firm not respecting such a request, but of course there is a

possibility that someone may tip off the present company about what their foreman is doing. But don't forget that if you have a well managed and efficient department, the tip may result in an unexpected increase in salary; at any rate, it is a chance you will have to take.

Then there is the possibility that if you are answering a blind advertisement, it may be that of the company you are working for. This is rather embarrassing, but it can always be avoided if you send your letter to the advertisement editor and explain that it is not to be put in the box if it is such and such a firm. If it should be so, he will destroy your letter, but he will not return it.

Always remember that a well trained, efficient foreman is not apt to be out of work very long.

George P Pearce
Albuquerque, NM

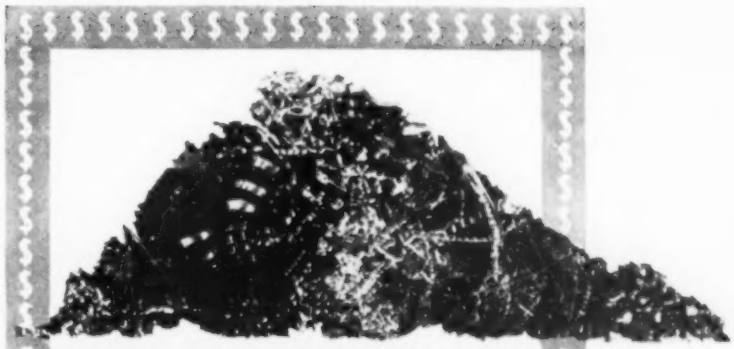
Tangents by Tange

TOO MUCH BRASS

Several years ago, the superintendent of a good-sized shop was visited by a youngster with authority from the head office to ask a lot of questions. It was obvious the youngster didn't know the business and his questions were not too bright, but the "supe" did his best to answer. He even explained the peculiarities of the process and the fact that only one or two other companies made the same product.

Six weeks later, the kid was back with more questions. This time they were more pointed and smart. Again he went away with the answers as nearly as a self-made shopman could satisfy a college-degreed non-shopman.

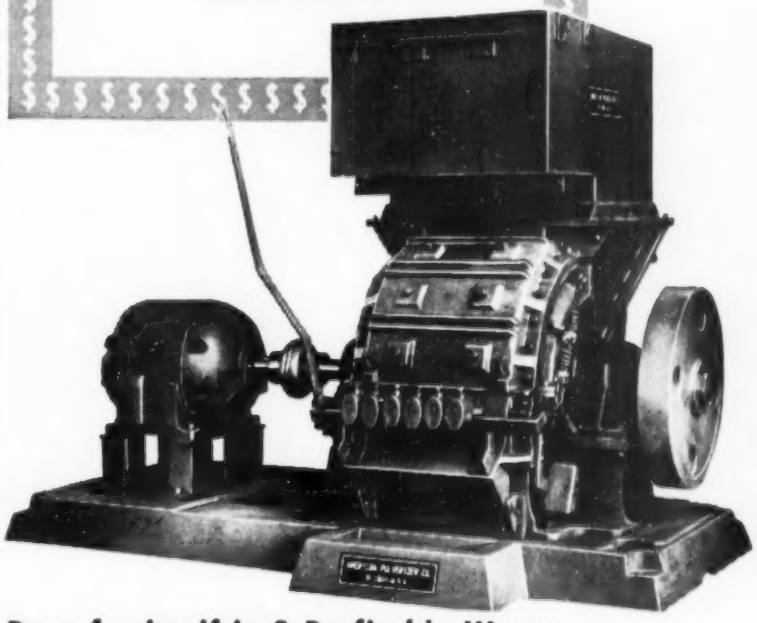
After a month or two, the youngster was back—this time with the company president, who promoted the superintendent to general manager on the spot. Turned out the youngster was with a consulting outfit that had been called in to see what could be done to cut production



THERE ARE EXTRA DOLLARS IN THIS SCRAP PILE!

...when you install an

American METAL TURNINGS CRUSHER



Pays for itself in 3 Profitable Ways:

1. **TOP SCRAP VALUE.** Uniform short shoveling turnings produced by an American bring up to $4 per ton more than regular machine shop turnings.
2. **INCREASED CUTTING OIL RECOVERY.** Up to 50 gallons per ton are released from turnings reduced in an American.
3. **EASIER HANDLING, STORAGE.** American-reduced turnings require but a fraction of the usual storage space... are easily briquetted.

Available in 1 to 10 tons per hour capacities to meet your needs. WRITE today for the complete American profit story.

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

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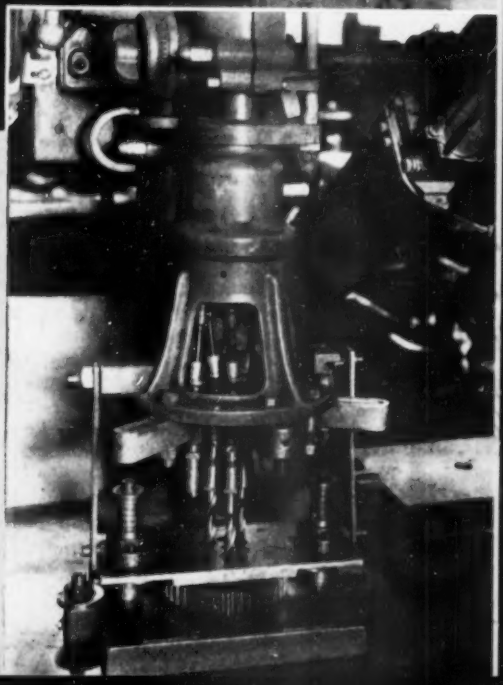
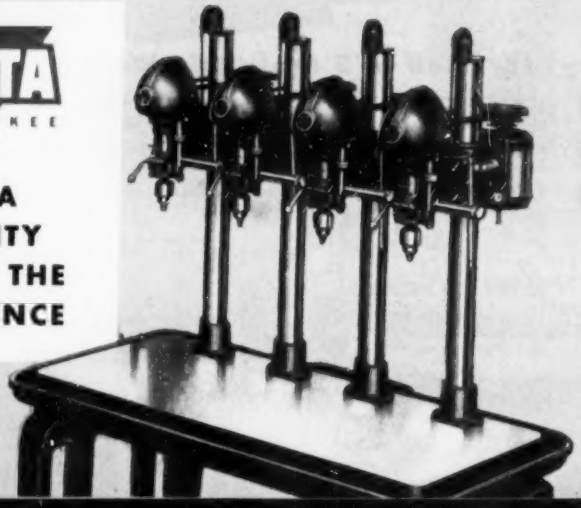
Our Production Jumped



DELTA
MILWAUKEE

DELTA QUALITY MAKES THE DIFFERENCE



300% with our First

DELTA Drill Press

says CHARLES LASLO, Superintendent, CLOYES GEAR WORKS, Cleveland, Ohio

4-spindle 14" drill press drills 4 to 6 holes at one time in timing gears—Chamfering is free operation—Machine used 30-40 hours per week, maintenance negligible.

- ***Another example of improved direct labor efficiency by using DELTA tools***

"In our pre-Delta era," says Mr. Laslo, "we used a 4-spindle drilling machine with flat-belt drive to drill and chamfer holes in timing gears used by leading auto builders. Belt slippage lost a lot of production and belt maintenance was high. Pieces were held by hand, and precision tolerances were hard to maintain.

"We bought a Delta 4-spindle, 14" drill press to do the combined drilling and chamfering operation on the gears. The No. 1 spindle was equipped with a fixture to hold the work, a multiple spindle head to do all the drilling, and a power feed.

"Chamfering became a 'free' operation because, while the No. 1 spindle goes through its automatic cycle, the operator chamfers the already-drilled piece from the previous cycle, puts it in the finished stock box, and gets a new piece ready.

"These operations are absolutely cost-free from a labor standpoint—compared with the old method.

"Also when time studies on one product proved that handling operations accounted for ⅓ of total cost, we installed another Delta single-spindle 14" drill press mounted on a wheel-equipped table. By moving the tool we eliminated most of the moving of the work.

"Recently, to deal with heavier volume we bought a Delta 17" drill press that drills $\frac{1}{16}$" and $\frac{27}{64}$" holes with extraordinary efficiency and accuracy."

Results speak for themselves:

- **Quality greatly improved—fewer rejects**
- **Operations eliminated**
- ***Production quadrupled***

Thousands of other Delta users are getting the same labor savings from multiple set ups that include the Delta 17" power feed drill press.

Can you win new "highs" in volume and quality? —most likely, yes! It's surely worth a little no-cost exploration. Talk to your Delta dealer—listed in the classified pages of your phone book under "Tools" or "Machinery"; and use the coupon to get the latest Delta AB-52 Catalog.

DELTA QUALITY POWER TOOLS

Another Product of **Rockwell**

ROCKWELL

Delta Power Tool Division
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( ) Please send me the name of my nearest Delta dealer
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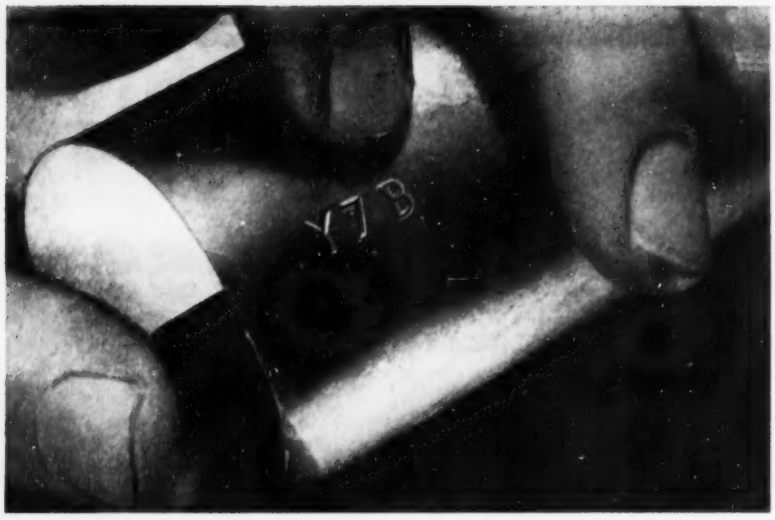

Sure of your Alloys?

Call Ryerson and Be Sure, 8 Ways!

Like the bar in this picture, *every bar* of Ryerson alloy steel has its mark—a symbol that identifies the particular heat from which the bar was rolled. And on all but the smallest bars this heat symbol is unmistakably stamped into the steel itself.

The result: Positive heat identification, just one of eight ways that we protect you against the many slips that could occur before the alloy steel you order reaches you.

Your protection begins with careful selection of the heats to be carried in our stock. Next, analysis is verified and all Ryerson alloys are spark tested to guard against mixed steels. Then the bars are color marked and stamped to identify type and heat.

Meanwhile, we test a sample of every heat for hardenability and interpret the test results for you. So, finally, when you call Ryerson for alloys, you can be SURE—sure of the steel you get and sure of what it will do.

Tested steel—racked separately by heats—is taken from stock; prepared to your specification; given a final inspection and shipped to you quickly. And with your steel (as-rolled or annealed), you receive complete test data to verify quality and guide your heat treatment.

This 8-point quality control is yours, at no extra cost, from Ryerson—and only from Ryerson. Just call your nearby Ryerson plant.

PRINCIPAL PRODUCTS IN STOCK: CARBON, ALLOY & STAINLESS STEEL—BARS, STRUCTURALS, PLATES, SHEETS, TUBING, ETC.

RYERSON STEEL

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA
CINCINNATI • CLEVELAND • DETROIT • PITTSBURGH • BUFFALO • CHICAGO
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costs. The consultants found production costs were already a third lower than those of any competitor, and methods better. The real problem was with the executive end. No economies the shop could make could pay for 13 vice-presidents and their satellites. The consultants showed how one vice-president and a number of retirements could change the profit picture.

DECAPITATION

In another plant, the president was the traditional hard-boiled one-man show. When he died suddenly, there was no successor, and it wasn't long before outside capital bought control and began to milk the business. Then banks came into control and the business was in the red to the tune of $50,000 a month.

Again a consultant was called in to cut production costs. His preliminary report showed that methods were good and costs were in line, but the yes men who made up company brass had never made a decision on their own and couldn't now. The consultant went on to recommend study of the management rather than the shop. That one drew a very cold stare from the bank executive, who was brass himself. End of interview.

Six weeks later, the consultant had a rush call to visit the banker, and was ordered on arrival to take over management of the company. Said the banker: "I thought your idea on the management was all out of line. But, after six weeks of trying to work with that bunch of Milquetoasts, I've just fired everybody from

"Just a departmental collection for Daniels—as you know, he received no overtime last week!"

Now... Longer Gage Life

...WITH TAFT-PEIRCE *Electrolized* GAGES

Experience proves that these electrolized Taft-Peirce Gages give many times longer life than ordinary hardened steel gages.

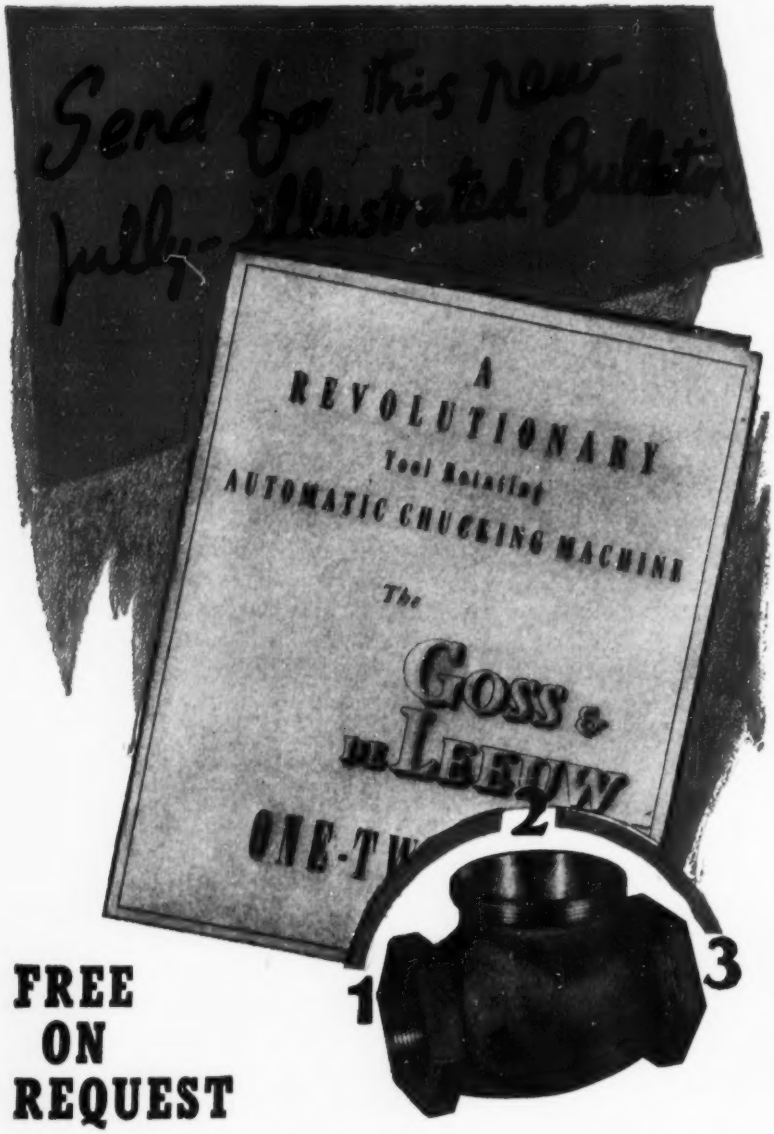
An even film of hard, non-magnetic alloy — only .000025″ thick — on all gaging surfaces provides exceptional wear-resistance.

Extremely smooth, this film has a very low co-efficient of friction, with high resistance to corrosion. Extremely tough, it won't chip, peel, or spall.

Electrolizing can be applied to standard or special gages and to CompAIRator Air Gage members. Accuracy is held to the same high standards as found in all Taft-Peirce gages. For more details, write today.

THE TAFT-PEIRCE MANUFACTURING CO.
Woonsocket, Rhode Island

T-P means Top Precision



FREE ON REQUEST

Here are the answers to most of your questions as to what "ONE-TWO-THREE" means in describing this outstanding development of Automatic Chucking Machines by Goss and De Leeuw. You'll be interested not only in the revolutionary design of the machine itself, but also in its extraordinary performance—and how it is possible to handle from one to three operations—in sequence or simultaneously without changing set up.

Get this interesting, informative Bulletin NOW—by merely asking for it.

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

the works manager up to the top."

The consultant explained that his organization only consulted — it didn't manage—but the banker insisted, and he was in a very tough spot. It was a case of put up or shut up. So the consultant moved in. Within six months, he and his staff had found ready and alert younger men *right in the decapitated company* to fill the top spots. He moved out again, with the company making $75,000 a month.

NO PLUG

These two cases are not intended as plugs for consulting firms, but to illustrate our point. The point is that everybody rushes to cut production costs whenever economies are in order — *particularly people who don't know anything about production.* We like to see production costs cut, but there's no point in fixing a leaky spigot while the barrel empties through the bunghole. You've got to "rare back" and look at the whole cost picture—including administration, engineering, purchasing, and sales.

Reminds us of the story of the top-brass conference in a big refrigerator plant in which the various vice-presidents of sales, engineering, and finance decided that it was advisable to cut $13.75 off the cost per unit for compressors if the company was to maintain its competitive position. When all the vp's had orated, the production manager was asked if he had anything to add. "I agree," he said, "that it would be a good idea to cut our cost per unit $13.75. But it's a little difficult to do, because the darn' thing only costs us $12.50 now!"

TOO MANY

Let's consider another plant. A bewildered executive handed us a set of figures and said, "Here's our cost picture. We're doing everything pretty well, as nearly as I can find out, but our net is poor. Look these over and give us an opinion."

As we are not in the consulting business, we could afford to be honest. Our reply was short: "Too many relatives." The brothers who founded the business some years back had had numerous sons, who in turn had been fairly prolific themselves—and every member of the family had a good title and a good salary, even if he was utterly useless or just needed one well-paid assistant to do his work for him. It wasn't a business, but a family-insurance company. The shop just couldn't support all the relatives and the staff necessary to run the business.

HOBBY

Variations of that case are endless —the second- and third-generation to-the-manor-born "executives" who run the business as a hobby between jaunts abroad, the cautious widow who decides to protect her inheritance by retrenching, the man who parlays an idea into a pile and then decides he's the final authority on everything. Typical of the latter is the company president we knew who achieved fame as an after-dinner speaker on economics, and eventually hired so many statisticians, draftsmen, and general flunkies that the stockholders rose in holy wrath and gave him and all his boys the opportunity to pursue his hobby without interruption.

We can't forbear mentioning the editor we knew once who devoted considerable time to the writing of a scholarly treatise on how to be a good technical editor. A few weeks after it was published, he was asked to resign. Whether his book revealed his inadequacy as an editor or as an author was never revealed by the publisher who fired him.

THE POINT

The point of these stories is essentially simple: Take care of your business, and your business will take care of you.

Please pardon us for retelling the story of the successful storekeeper who lay on his deathbed. His wife, thinking to ease his dying moments, assured him that every one of his sons and daughters was at his bedside. The old storekeeper sat bolt upright in bed and shouted: "Then who the Hell is taking care of the store?"—EJT

"You're got a fine mind, Harry and you're up for promotion . . . so don't read those cheap dime comic!"

Backstand Belts increase production 40%!

Three operations become two— using an Armour Backstand Belt

Sanding, polishing and finishing cast aluminum motor housings were three jobs for a well-known company*, using a hard wheel and two set-up wheels. One Armour backstand belt combined the sanding and polishing operations, increasing production 40%! It outlasted 4 to 5 wheels, and gave a better finish!

Belts are only one of the many forms of Armour coated abrasives. There are more than 30,000 different varieties in form, grit size, backing, etc., to meet your specific requirements. Your industrial distributor will tell you about this complete line. Call him today!

The booklet offered below will save you money in storing coated abrasives. Send for your free copy now.

We recommend buying through your industrial distributor.

*Name of company available on request.

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Please send me the free booklet "How to Store Coated Abrasives."

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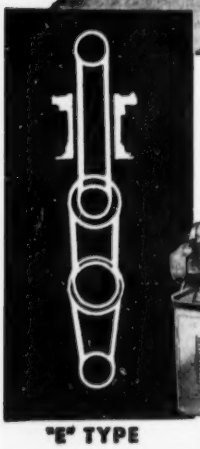
A

SHELDON
CHICAGO
PRECISION LATHES

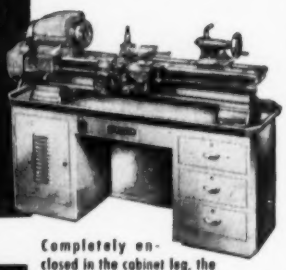
More Power
to the point of work

To insure delivery of full power at the point of work . . . to prevent slippage on heavy cuts, the underneath motor drives of SHELDON Precision Lathes have double V-Belts driving the spindle. Tandem V-Belts, each of which engages the spindle around a full 50% of its circumference.

You will note a feature of SHELDON underneath motor drives not common to other moderate priced lathes is the extra, underneath counter shaft that permits driving thru a *standard* 1-piece lathe bed. There is no cutting away of the bed for belt clearance, nor use of "spliced" beds, in SHELDON Precision Lathes.



"E" TYPE



Completely enclosed in the cabinet leg, the the SHELDON Type "E" Underneath Motor Drive has matching 4-step, V-Belt sheaves which provide 4 speeds (8 spindle speeds). All belts are provided with individual means for permanent adjustment of tension.

"U" TYPE

With a SHELDON Type "U" Underneath Motor Drive, all speed changes are instant—are made by clutches operated by levers that are conveniently located outside the enclosed cabinet leg. 4-speeds (8 spindle speeds) and individual belt tensioning means are provided.

Write for Catalog

SHELDON MACHINE CO., INC.
4234 North Knox Ave., Chicago 41, Illinois

NEW BOOKS

PERSONNEL SERIES, *Booklets 142, 144, 145, 146, 147. Published by American Management Assn, 330 W 42nd St, New York 36, N Y. 28 to 44 pages each. 6×9 in. Price $1.25 (for non-members).*

Booklet 142 in this regular series by AMA is "Preparing Employees for Retirement," and consists of three papers from an AMA meeing. They cover the pros and cons of compulsory retirement, retirement planning, and conflict and agreements in personnel relations.

Number 144 is titled, "Operating Problems of Personnel Administration," covering top management and personnel administration, recent developments in merit ratings, the older worker, employee economic education, and motivating employees to work.

Booklet 145 is "Practical Approaches to Supervisory and Executive Development," covering progress on executive development, how to make workers want to become foremen, supervisory compensation, and spreading economic understanding.

Number 146, "Significant Issues in Current Collective Bargaining," includes a panel discussion at an AMA meeting.

The last is 147, "Spotlighting the Labor-Management Scene," three papers on labor and productivity, and a panel discussion.

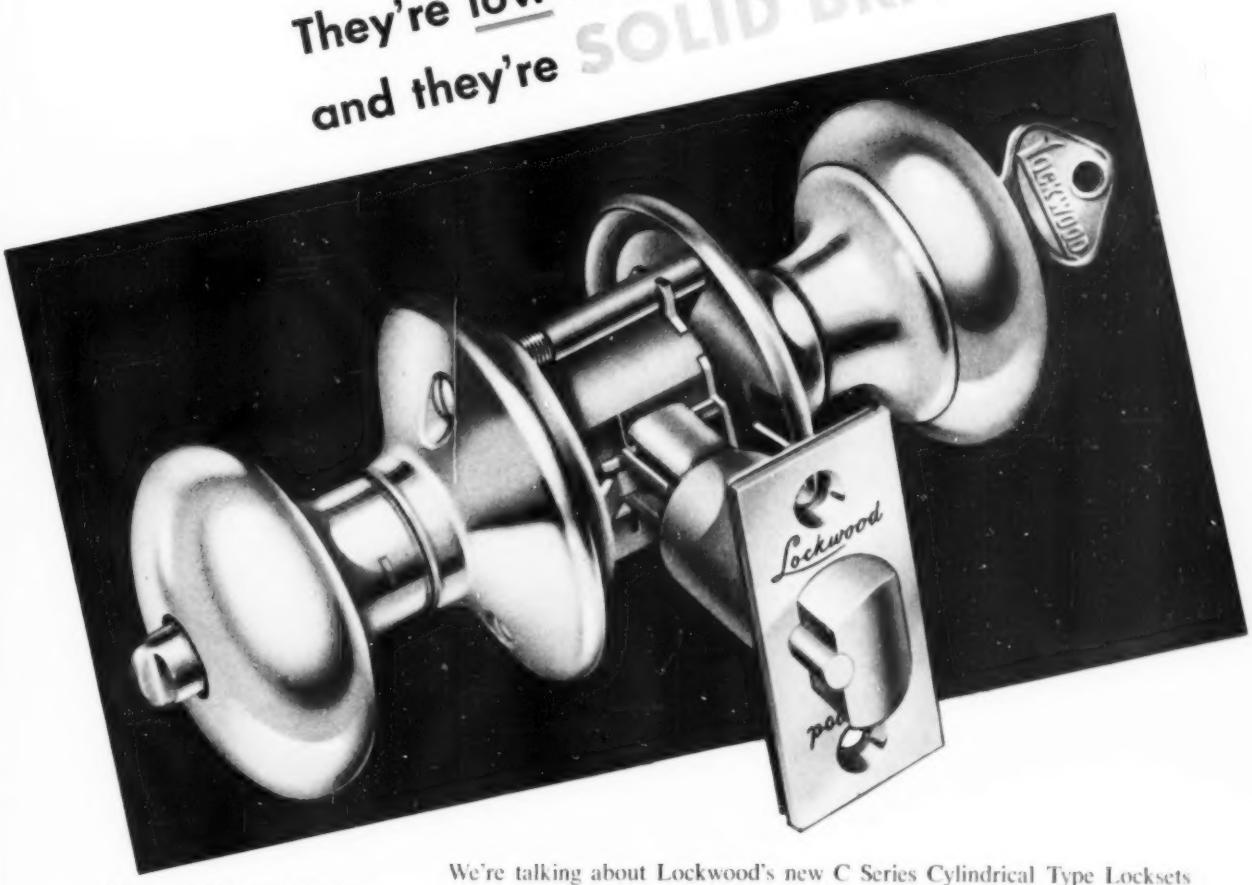
•

LES RENDEMENTS PLANETAIRES EN DIAGRAMMES (PLANETARY EFFICIENCY IN DIAGRAMS) — *By G Fleischel. Published by Dunod, 92 Rue Bonaparte, Paris, France. 52 pages 8½×10¾. Paper bound. Price 1380 Francs.*

Determination of planetary gearing efficiency has long plagued design engineers with a lengthy and tedious series of calculations. In this book, the author offers a series of charts from which it is possible to determine, by direct reading, the efficiency of any given train.

To facilitate use of the charts, he reviews the properties of planetary mechanisms, knowledge of which is essential for a proper understanding of what follows. He underlines and explains the factors to be considered, and shows all the various situations that may be encountered.

They're new
They're high in quality
They're low in price
and they're SOLID BRASS



This new C Series Cylinder Type Lockset is made by Lockwood Hardware Mfg. Co., Fitchburg, Mass., Division of Independent Lock Company. Anaconda Metals in a variety of alloys were especially adapted to its "solid brass" construction.

We're talking about Lockwood's new C Series Cylindrical Type Locksets recently introduced to the trade. An entire new plant was built for their production.

Here, for the first time in Lockwood's history, ease-of-installation, ruggedness, smooth operation, outstanding design and long life were engineered into a lockset in one fell swoop, aimed specifically at the low-price field.

Time-tested brass is used in every wear-and-weather-vulnerable spot: turnbutton, knobs, knob shanks and inserts, roses, latchplate, auxiliary locking plunger — right down to the pins, springs, tumblers and extruded shell of the cylinder lock.

It took a bit of doing to determine the right Anaconda Copper Alloy, in just the right temper, gage and grain size for each of the several different functions and fabricating operations involved. But then, that's been the business of The American Brass Company for a long time. Maybe we can be of service to you? Address: The American Brass Company, General Offices, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

5369

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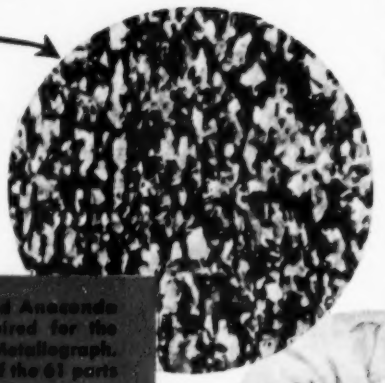
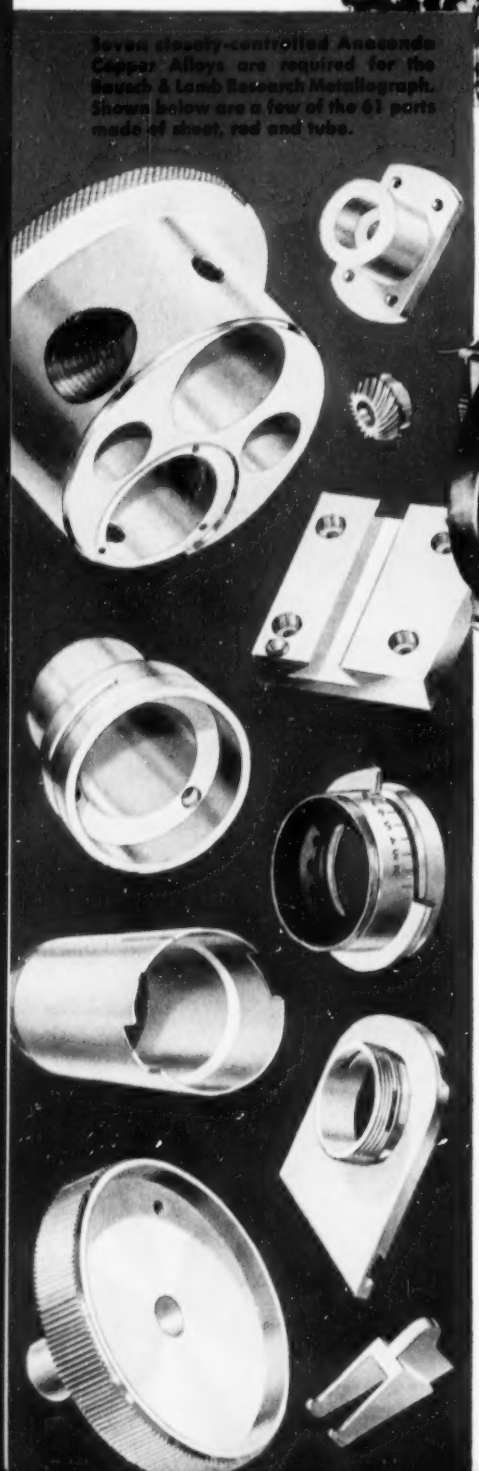
to Bausch & Lomb:

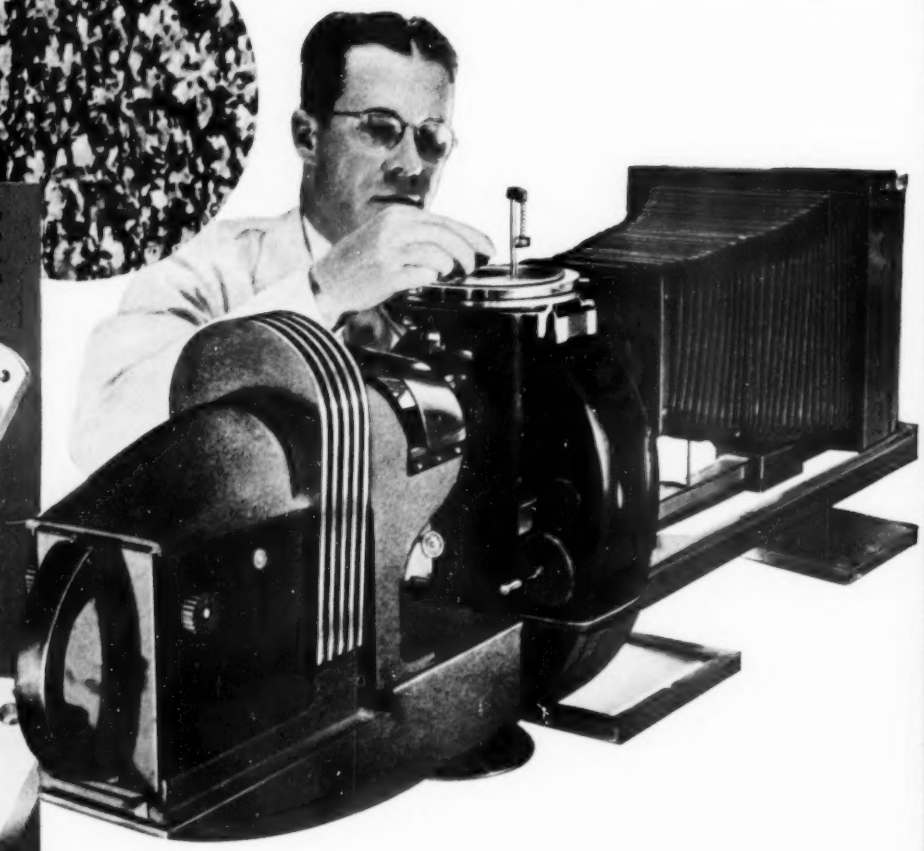
may the second 100 years be as productive as the first!



HERE ARE TWO PICTURES OF THE SAME THING . . . above a section of Tobin Bronze* Rod. At right a micrograph at 75 diameters of a polished and etched specimen cut from the rod. *Reg. U. S. Pat. Off.



Seven closely-controlled Anaconda Copper Alloys are required for the Bausch & Lomb Research Metallograph. Shown below are a few of the 61 parts made of sheet, rod and tube.



To Bausch & Lomb Optical Co., which this year is celebrating its 100th anniversary of manufacturing fine optical instruments, America owes a debt of thanks. Through its development of scientific equipment, this pioneer optical firm has helped American science and industry to apply modern precision methods to research and production.

One example of fine Bausch & Lomb industrial optical equipment is the B&L Research Metallograph. With this precision instrument a skilled laboratory technician may examine and photograph metal structure at high magnification. To build it Bausch & Lomb uses 61 parts made of seven Anaconda Copper Alloys. Eight parts are formed from tube, 16 from strip and 37 from rod. Of what advantage are these alloys? They provide accurate, smooth surfaces on delicate working parts. They lead to production economies through higher machining speeds and longer tool life.

With such a variety of wrought forms available, there's little wonder that so many instrument makers depend on copper alloys . . . from the mills of The American Brass Company. General Offices, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 5389

ANACONDA

COPPER · BRASS · BRONZE made by The American Brass Company

Typical examples are given to show why sometimes excellent efficiencies are obtained, sometimes poor. From these, a series of directions are given to guide the engineer in his research. Eleven charts are given, together with two transparent plastic scales to be used in connection with them.

Engineers with a knowledge of the French language will find this a most valuable time saver.

•

GENERAL GUIDE IN COMPILING A SYLLABUS OF TRAINING FOR APPRENTICE TOOL MAKERS — *Published by the Gauge and Tool Makers' Association, Standbrook House, Old Bond St, London N W 1, England. 18 pages, 8x10 in. Price 5 shillings.*

Always conscious of the need for properly trained toolmakers and of the importance of adequate training programs, the Association has prepared this booklet as a guide to companies interested in establishing apprentice-training programs. It is appreciated that not all companies will have all the facilities or equipment for offering the entire syllabus to their apprentices, but the document is intended as a general guide, usable in whole or in part, for laying out a course of training.

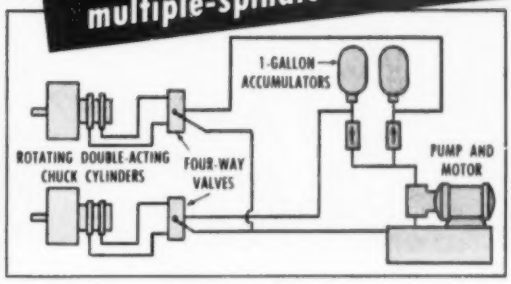
Because the length of time required in any section will vary with the aptitude of the individual, no suggested times are given, nor is it considered important that the sequence be maintained. However, it is stressed that turning, milling or grinding, and bench work are essential.

The council of the Association strongly recommends that toolmaker apprenticeships be by signed indenture, as this provides the young craftsman with a permanent record of his training and offers useful

"I told you to keep your lunch bucket away from the furnace!"

IMPACT for Chucking

GREER ACCUMULATORS deliver hydraulic SURGE on multiple-spindle machines



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2. PRESSURE-VOLUME COMPENSATOR for
   a. Leakage compensation.
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3. DISPENSER OF FLUIDS and Lubricants.
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5. SHOCK ABSORBER to
   a. Absorb line shocks.
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Greer Accumulators deliver the hammer-like blow on the chuck jaws required to seize and release work on automatic multiple spindle machine tools. In the above simplified, schematic diagram the Greer Accumulator not only supplies power for actuating the chucks but also maintains line pressure for holding the work securely. A low-volume, high-pressure pump charges the accumulator during intervals between chucking. Without the accumulator, a pump to deliver the required surge of fluid would have to be so large and costly as to be economically impractical.

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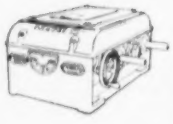
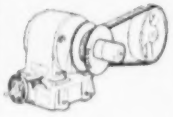
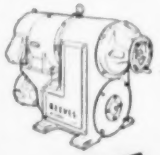


Vari-Speed Motor Pulley: converts any constant speed motor to a variable speed drive. 4:1 speed ratio. Sizes to 10 hp.



Motodrive: combines motor, speed varying mechanism and reduction gears in one unit. 2:1 to 6:1 speed ratios. Fractional to 25 hp.



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evidence when applying for higher positions. Copies on a model indenture are available from the association.

•

ENGINEERING DRAWING *(Eighth edition)—By Thomas E French and Charles J Vierck, with the assistance of Charles D Cooper, Paul E. Machovina, Ralph S Paffenbarger, and Hollie W Shupe. Department of Engineering Drawing, Ohio State University. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, N Y. 715 pages. Price $7.75.*

The latest edition of this old standby—standard text in many colleges and universities—has been revised to include modern methods and practices of engineering drawing. One feature of the book may do considerable good in simplifying the troublesome and sometimes complicated subject and practice of technical drawings: Chapters are divided into four sections; shape, size, machine elements, and working drawings.

Illustrations are excellent, as usual, and include some additions. Most of the chapters have been revised to some extent. The book continues to be the outstanding text on the subject.

•

MATERIALS HANDLING—*By John R Immer, Professor of Industrial Management, The American University. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, N Y. 519 pages. Price $5.50.*

One automotive company considers materials handling the most important area for increased efficiency in manufacturing that exists today, and many other manufac-

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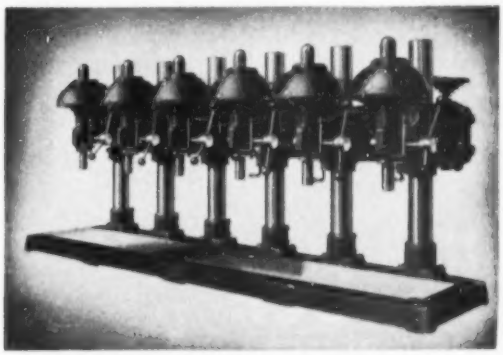

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turers are coming to that idea. It is a big business; the author estimates that US industry could save $2 billion in one year of concentrated materials-handling improvements.

The author has taken a fundamentally sound approach to the problem of better materials handling in this text. He ties in with motion and time study, an important point if handling improvements are not simply to be superficial. He considers the various physical handling directions—horizontal, vertical, sloping—and covers the equipment available for each kind of job. He also considers selling materials handling in industry, costs, organization, safety, operator training. And he takes several different industrial applications separately—as air cargo, ship handling, etc, to show how better handling methods can be applied.

One drawback to this book is its archaic illustrations and layout; for a new book it is not in accord with modern methods of visual presentation, nor are the photos and drawings of top quality. There is a fair number of illustrations, but treatment is poor.

•

WILLIS HAVILAND CARRIER, FATHER OF AIR CONDITIONING—*By Margaret Ingels. Published by Country Life Press, Garden City, L I, N Y. 170 pages. 8½ × 5¾ in. Price $2.50*

This is the story of Willis Carrier's working life, up to date, and includes considerable detail information—non-technical—about the development of air conditioning.

Willis Carrier is evidently an unusually outstanding man. During school life, for example, he would

"—I don't care if you are going to be a production Supervisor. Never use those words again!"

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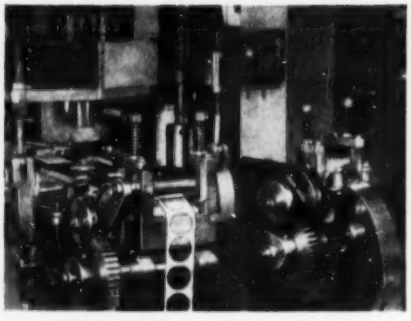

Ball bearing die during pre-test run on customers' equipment. First step of exhaustive tests before die is certified "PRODUCTION PROVED."

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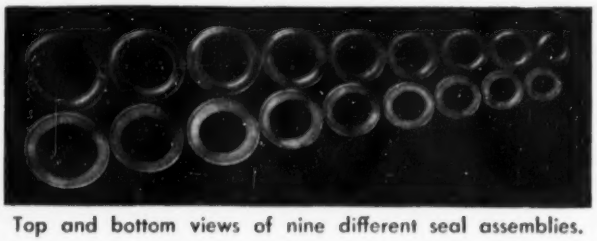

Top and bottom views of nine different seal assemblies.

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work on problems years ahead of his class, although he sometimes neglected the simpler day-to-day homework that his mates managed to accomplish. He was stumped by fractions until his mother cut up an apple to demonstrate the idea.

His aptitude for invention was bolstered greatly by a methodical and stubborn mind that held to a problem until solved. He was practical, too, and worked seriously only on ideas that looked to be usable, saleable, and therefore profitable—a quality lacking in many more noted but less continually successful inventors.

His organization of the company that bears his name started air conditioning, which has grown to a full-fledged industrial field. The book traces his development as an industrial leader along with the expansion of his work and company.

•

SIMPLIFIED DRAFTING PRACTICE—By *William L Healy and Arthur H Rau, General Elecric Co. Published by John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, N. Y. 156 pages, 9x11 in. Price $5.*

Here is a book that suggests and shows methods for simplifying drafting practice, an art that has not changed much in many years. The authors do not propose a wholesale substitution of simplified practice, but do recommend simplification where detail is not necessary. And it frequently is not, particularly on follow-up and substitution drawings. In fact, simplification ideas can be applied to almost any kind of drawing except perhaps original design sketches and the like.

The book contains many examples

"Their ideas used to bother me . . . then I had the suggestion box attached to the incinerator!"

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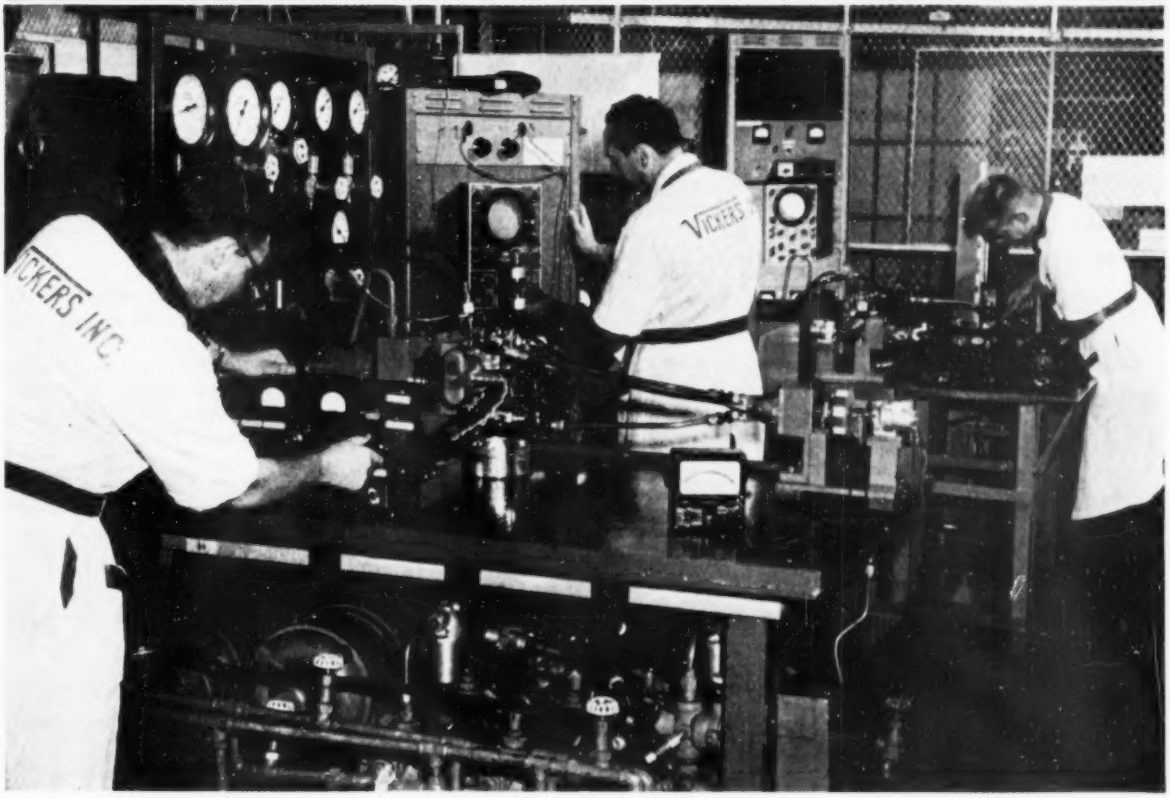

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of simplification and a high number of actual drawings. Chapters cover the principles, application, freehand worksymbols and abbreviations, drafting aids, and reproduction of drawings. It is not intended to be a text, but to suggest ideas that may be applied in plants according to individual preferences and needs.

It is a practical book for engineering-shop use, particularly if drafting is a problem and if more time must be provided than is available. Ideas follow and expand on current simplification standards, like the symbols for threads, and add more possibilities.

•

AMERICAN STANDARD INVOLUTE SPLINE AND SERRATION GAGES AND GAGING—*ASA B5.31 — 1953 — Published by the American Society of Mechanical Engineers, 29 West 39th St., New York 18, NY. 22 pages, 8½ × 11. Price $1.25*

This standard covers the types of gages for different types of fits, and several systems of gaging to meet the demands of various industries. Specifications for gages in this standard are based on ASA B15-1950, "Involute Splines," and ASA B5.26-1950, "Involute Serrations." The basic principles are applicable to all involute splines and serrations.

•

NONFERROUS PHYSICAL METALLURGY—*By Robert J Raudebaugh, prof, Georgia Institute of Technology. Pitman Publishing Co, 2 West 45th St, New York, N Y. 345 pages. Price, $6.50.*

Pitman has six books in a metallurgy series, of which this book is the latest. The author has placed most emphasis upon alloy systems (cop-

"Which one was it who mistook me for Marilyn Monroe?"

Miller

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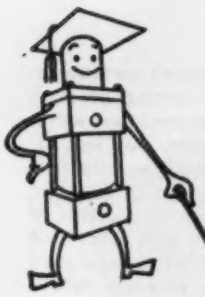

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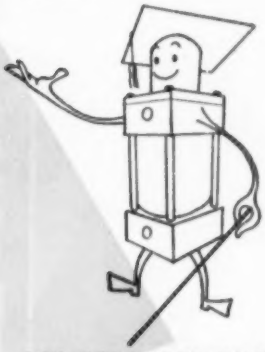

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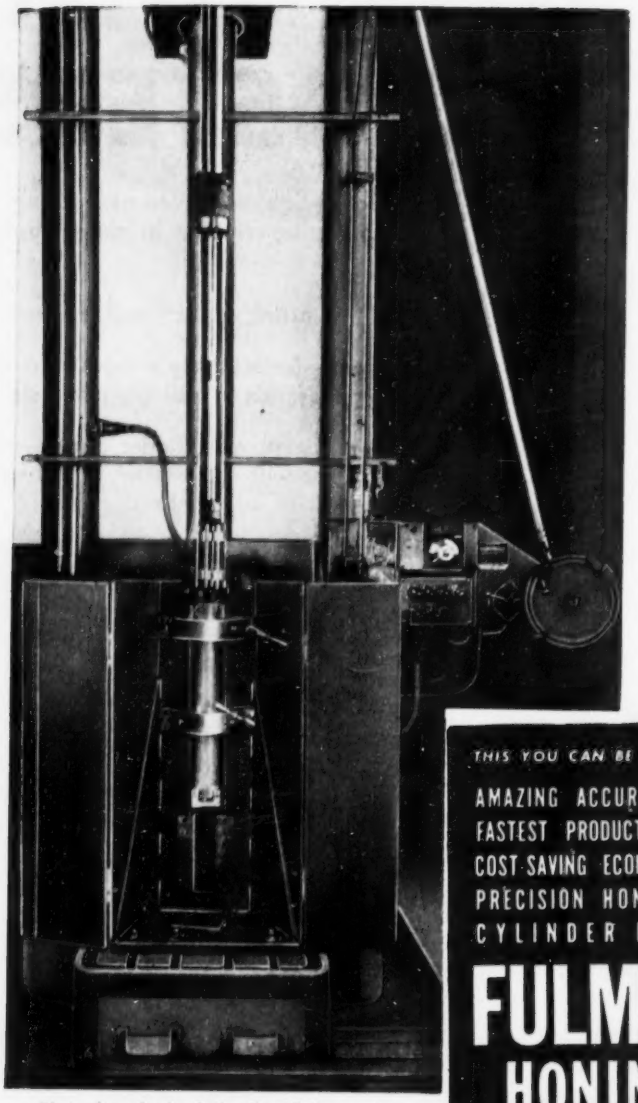

THIS YOU CAN BE SURE OF:

AMAZING ACCURACY . . .
FASTEST PRODUCTION . . .
COST-SAVING ECONOMY ON
PRECISION HONING OF
CYLINDER BORES

FULMER HONING MACHINES

Photo shows honing hydraulic cylinders on famous "Payloader" built by The Frank G. Hough Co., Libertyville, Ill.

PRODUCTION IS FASTER because the abrasive stones cut the material. Chips run as long as SIX INCHES. Merely rubbing away (as some honing processes do) isn't fast enough and costs too much.

The rugged construction and precision engineering provide plus-capacity which is appreciated under today's conditions . . . even on a three-shift, seven-day basis.

Hone as much as 1/16 inch of material at 1¼ to 2 cu. in. per minute. And that's F-a-s-t!
For ferrous and non-ferrous metals, plastic, glass etc.

Write for your copy of bulletin on honing.

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per alloys for example) metallography, melting and casting practice, hot working characteristics as in rolling and extrusion, but less attention to coldworking, as would be expected. He covers: aluminum; magnesium; nickel alloys; alloys of cadmium, lead, tin and zinc; and some of the less widely known nonferrous metals like precious metals, molybdenum, tantalum, cobalt, and titanium. A chapter is devoted to powder metallurgy. The book appears to be a sound and worthwhile addition to the library of persons who work non-ferrous metals.

•

INVESTMENT CASTINGS FOR ENGINEERS —*By Rawson L Wood, pres, Arwood Precision Casting Corp, and Davidlee Von Ludwig, consulting materials engineer. Published by Reinhold Publishing Corp, 330 W 42nd St, New York, N Y. 477 pages. Price, $10.*

The work of these authors is not strange to readers of *American Machinist*, because several of the chapters were published as articles or Special Reports prior to book manufacture.

Our reasons for publication of the articles coincided with the objectives of the authors: Investment casting jumped from the dental-mechanics laboratory into industrial use only a few years ago, and the sum total of published knowledge had been sketchy. Hence, a real need exists for a sound text, so that engineers can acquaint themselves with the advantages and limitations of investment castings.

Sufficient definition of technique has been incorporated in the 20 chapters to acquaint prospective users of investment castings with their advantages, and what you can

"I think I've solved the loafing around the water cooler problem J.C.!"

"Pop says they're givin' production like his

Logan LATHES!"

No. 935—2
QUICK CHANGE GEAR TURRET LATHE
11" Swing, 1" Collet Capacity,
1⅜" Spindle Hole, 43⅛" Bed

METALWORKING PRODUCTION lines in many industries have found Logan Lathes the key to profitable operation. Set-ups are faster. Power cost is less. The sustained accuracy of the Logan ball bearing spindle holds close tolerances at high speeds. The rugged durability of Logan construction keeps production going at top efficiency and minimum cost per finished part. With their 11" swing, 1" collet capacity and 1⅜" spindle hole, rugged accurate Logan Lathes are standard tools on many of industry's most efficient production lines. Remember, as you plan for low cost production, no other lathe of comparable specifications can match Logan economy.

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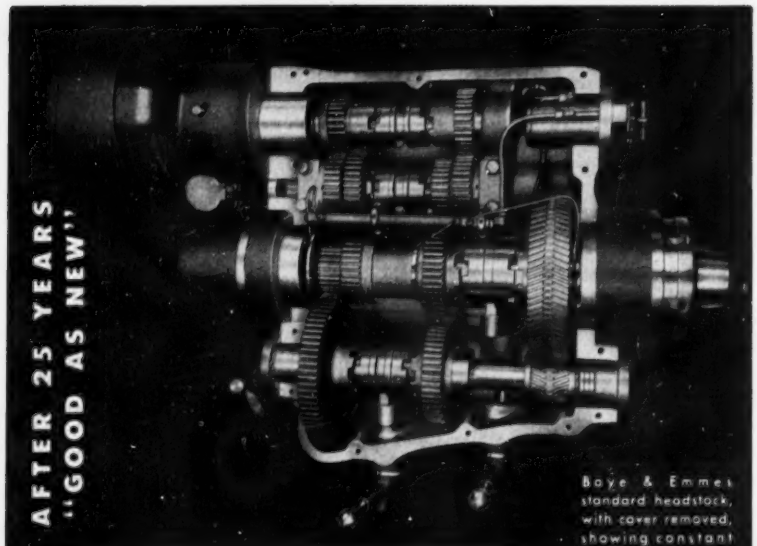


Boye & Emmes standard headstock, with cover removed, showing constant mesh, wide face gears and large diameter, positive jaw, sliding clutches.

THE LATHE CAME BACK*

-After 25 Years-

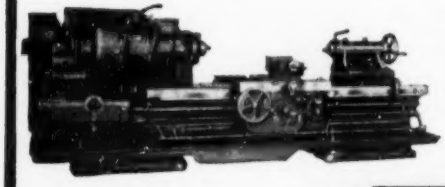
•

HEADSTOCK GEARING
"GOOD AS NEW"

Boye & Emmes Engine Lathe No. 300-141, owned by The Timken Roller Bearing Company, Canton, Ohio, was returned for factory inspection after twenty-five years of day-in-day-out use. During this period, Timken purchased repair parts from us, for this machine, to the extent of $154.15. Yet, when the headstock cover was removed at the factory the gearing was found to be "as good as new." This is usual.

CONSTANT MESH GEARS
POSITIVE JAW SLIDING CLUTCHES
SPELL OUT THE ANSWER

The principle of power transmission which is used in Boye & Emmes Engine Lathes incorporates constant mesh headstock gearing, with speed changes effected through positive jaw, sliding clutches. This construction eliminates gear wear due to shifting action, allows shorter shafts, less space between bearings, and hence more accurate and rigid construction.



FREE LITERATURE

If you are not now using Boye & Emmes Long Life Engine Lathes, investigate. Compare this lathe of low maintenance and high accuracy from every viewpoint. Specifications and details of construction for all sizes are contained in our free Bulletin No. 601. Write for it today!

*One of many documented cases of "no wear" in Boye & Emmes constant mesh lathe headstock, after years of use.

LONG LIFE LATHES

BOYE & EMMES
MACHINE TOOL COMPANY
125 CALDWELL DRIVE
CINCINNATI 16, OHIO

and cannot expect. Therefore the subjects covered include: description of investment casting, the master pattern and pattern die, making soft metal dies, wax versus plastic patterns, and frozen mercury for disposable patterns. Process details are continued with gating, risering, clustering and venting wax and plastic patterns. Information is supplied on investment materials and techniques and melting and casting the alloys.

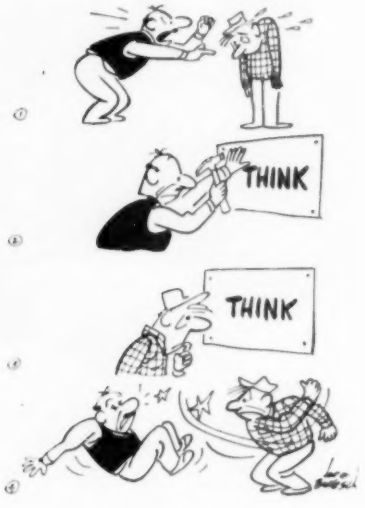
With this background on the process itself out of the way, the authors proceed to tell about selection of alloys for investment casting, how to machine them when necessary; product design development by means of investment castings, and design suggestions.

Although a great deal of the information for the book was developed from the technical knowhow of Arwood personnel and tests made at that plant, additional information was secured from other major investment foundries. Therefore, as the first known book in the field, this volume undoubtedly represents a thorough resume of the art as it now stands.

•

ELECTRIC CONTROL SYSTEMS *(Third edition)—By Richard W Jones, Professor of Electrical Engineering, Northwestern Technological Institute. Published by John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, N Y. 511 pages. Price $7.75.*

Tying together theoretical knowledge absorbed in school to produce an understanding of how practical applications really work is a tough job. It's what this book attempts.



Now, a complete new 20-page catalog for the Waldes Truarc Grooving Tool

• • • the One Versatile Tool Designed for High Speed, Precision Cutting of Internal Grooves in Housings and Bores

Here is the most complete catalog ever published — on the cutting of internal concentric recesses. Complete with descriptive, illustrated information and data charts showing how the Waldes Truarc Grooving Tool can solve virtually every internal grooving problem you may have. Shows how even *unskilled labor* can perform precise, production-line operations.

- Facts and figures on the Waldes Truarc Grooving Tool . . . its special features, modifications and adaptations.
- Data showing how the Waldes Grooving Tool cuts accurate grooves in housings with diameters from .250 to 5.000 inches.
- Charts describing various cutters: single, multiple, beveled and special profiles. Description of bottom adaptors, elongated spindles, and extended bushings . . . for solving particular problems.
- Location of grooves under varying conditions: in bores, housings, and blind holes.
- Diagrams and easy-to-follow instructions on the set-up of the Grooving Tool.
- 5 full pages showing 17 case histories covering the range of typical problems and solutions.
- Complete information on how to select the right model tool . . . and the right accessories . . . for your particular job.

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FOR HIGH GRADE
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Guaranteed accurate to good commercial standards.

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for the text brings together all the separate elements of electrical control — motors, machinery, switches, relays, circuits, and what all. It is therefore an advanced course in electrical engineering, for which purpose it was written.

Here are sample chapter headings:
DC motor characteristics
Electromagnetic contacting devices
Electronic switching circuits
Power amplifiers
Basic motor-control circuits
Feedback control
Motor protection

Both analysis and graphic methods are utilized to develop basic ideas, and problems are included to bring out points not covered in the text—thus making the book classroom tool.

However, there is a good amount of practical, detailed information in the text, making it suitable for some reference purposes It would probably serave a good many engineers well when they need added information in a field in which they are only moderately well informed, and it would also probably help as a technical reference during the selection of electrical equipment for the plant.

The book is well, though not profusely, illustrated and equipped with diagrams. Bibliographies are included for further information, and sources of information, such as technical magazines and other books, are given.

•

HISTORY OF STRENGTH OF MATERIALS—*By Stephen P Timoshenko, Prof of Engineering Mechanics, Stanford Univ. Published by McGraw-Hill Book Co., 330 West 42nd St, New York, N. Y. 452 pages. Price, $10.*

One might wonder why anyone other than a college professor with a real love for his subject would "give a hoot" about a history of the strength of materials. And yet there must be some engineers who would like to have this book. For a history of the subject, as written by such an eminent authority as Prof Timoshenko, must have a purpose and a value. Perhaps this value is the creation of an awareness of the basic purposes of the research carried out by investigators in many countries and in different periods. Possibly, the practical applier of strength of materials concepts will find the key to his problem. Otherwise, it would seem that the chief purpose of this book is to enlighten and to stimulate the minds of those who have a bent toward research, rather than to be of assistance to persons concerned with the practical everyday application of engineering knowledge.

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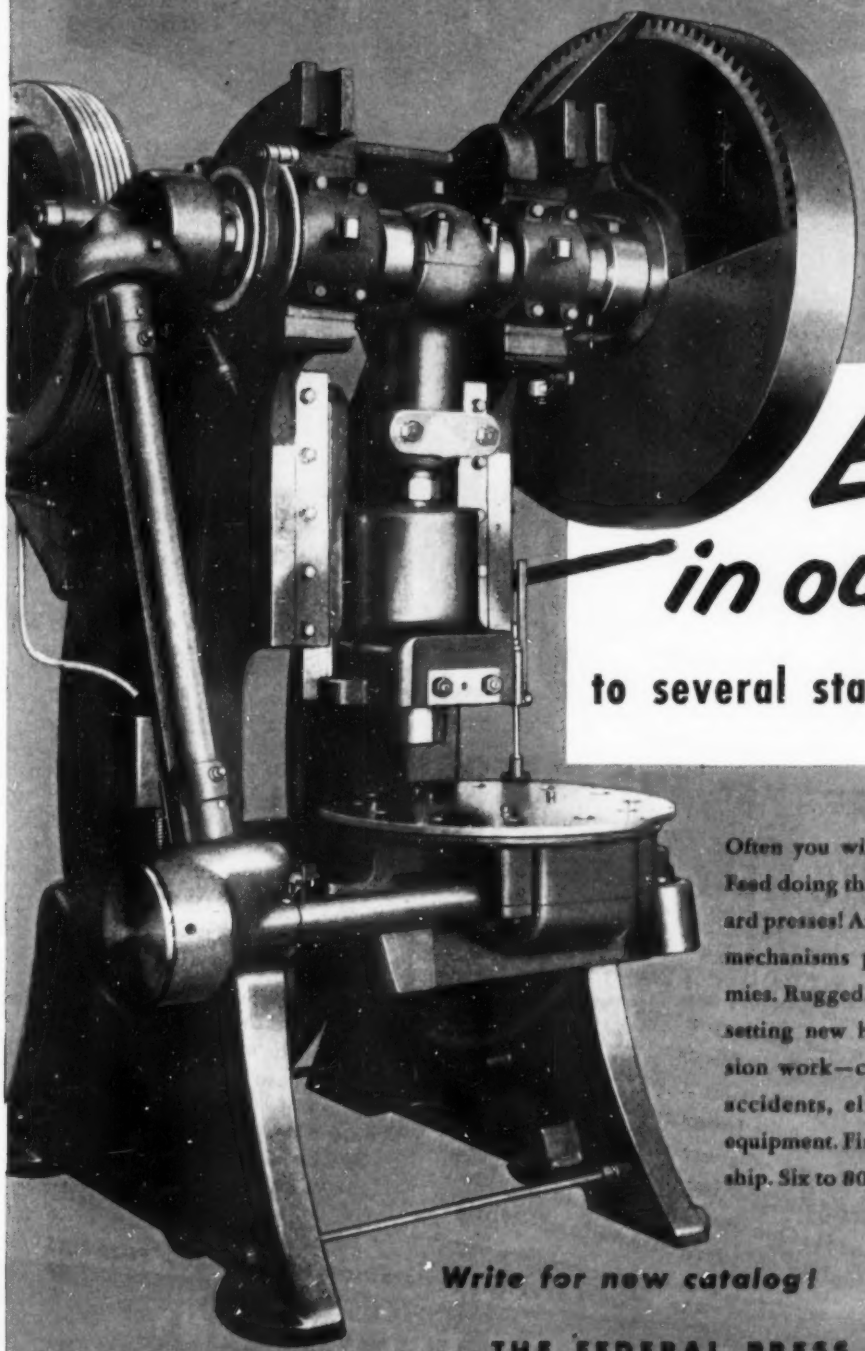

No. 7 Dial Feed
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Equal in output—

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Often you will find a *single* Federal Dial Feed doing the work of three to five standard presses! Automatic loading and ejector mechanisms provide still further economies. Rugged, precision-built Federals are setting new highs in faster, safer, precision work—cutting down-time, reducing accidents, eliminating more expensive equipment. Finest materials and workmanship. Six to 80 tons. Also standard presses.

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FOR APPEARANCE AND PERFORMANCE

SQUARE D's NEW REVERSING DRUM SWITCH

DESIGN LEADERSHIP FEATURES

Compact Size · Large Screw type Terminals · Replaceable Terminal Blocks · Convertible from Maintained Position to Spring Return · Positive Shock-proof Indexing · Single Captive Cover Screw · Generous Wiring Space · Two ½" Conduit Openings at Bottom · Front or Rear Handle Operation · Large and Legible Nameplate · Modern Streamlined Styling

This Class 2601 Reversing Drum Switch is a "natural" wherever the direction of rotation of a small motor is to be manually controlled. It can be used with single phase, polyphase and D. C. motors.

Bulletin 2601-A gives complete details
Write Square D Company,
4041 N. Richards St., Milwaukee 12, Wis.

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Bellows DRILL PRESS FEED

TURNS HAND-FED DRILL PRESSES INTO AUTOMATIC DRILLING MACHINES...

The Bellows Drill Press Feed attaches to the star wheel shaft of any standard drill press. At a touch on the operating handle the Feed advances the spindle rapidly to the work, feeds the drill into the work at an exactly controlled feed rate and thrust; and, when the drilling stroke is completed, automatically returns the spindle to starting position, and stops. Easily accessible controls provide accurate feed rate adjustments for any tool working in any material, at the breakthrough or at any pre-determined point.

The Bellows Drill Press Feed is inexpensive. Prices start at $164.00. It can be transferred from one drill press to another in less than half an hour. It doesn't interfere with hand operation of the drill press. It can be readily synchronized to Bellows work holding and work feeding devices. Relatively unskilled help can do top quality work with it. Frequently a single operator can run as many as three drill presses.

More than 10,000 companies use Bellows Drill Press Feeds. In some plants as many as 400 Feeds are in everyday use—drilling, tapping, reaming, counter boring, threading—building production records that are hard to believe unless you use Bellows Drill Press Feeds yourself.

- **INSTALLS IN LESS THAN HALF AN HOUR**
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WRITE TODAY FOR *Free* BOOKLET

16 pages of facts on how you can use Bellows Drill Press Feeds to cut your drill press costs to a new low.

Address: The Bellows Co., Dept. AM-653, Akron 9, Ohio.

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Controlled-Air-Power

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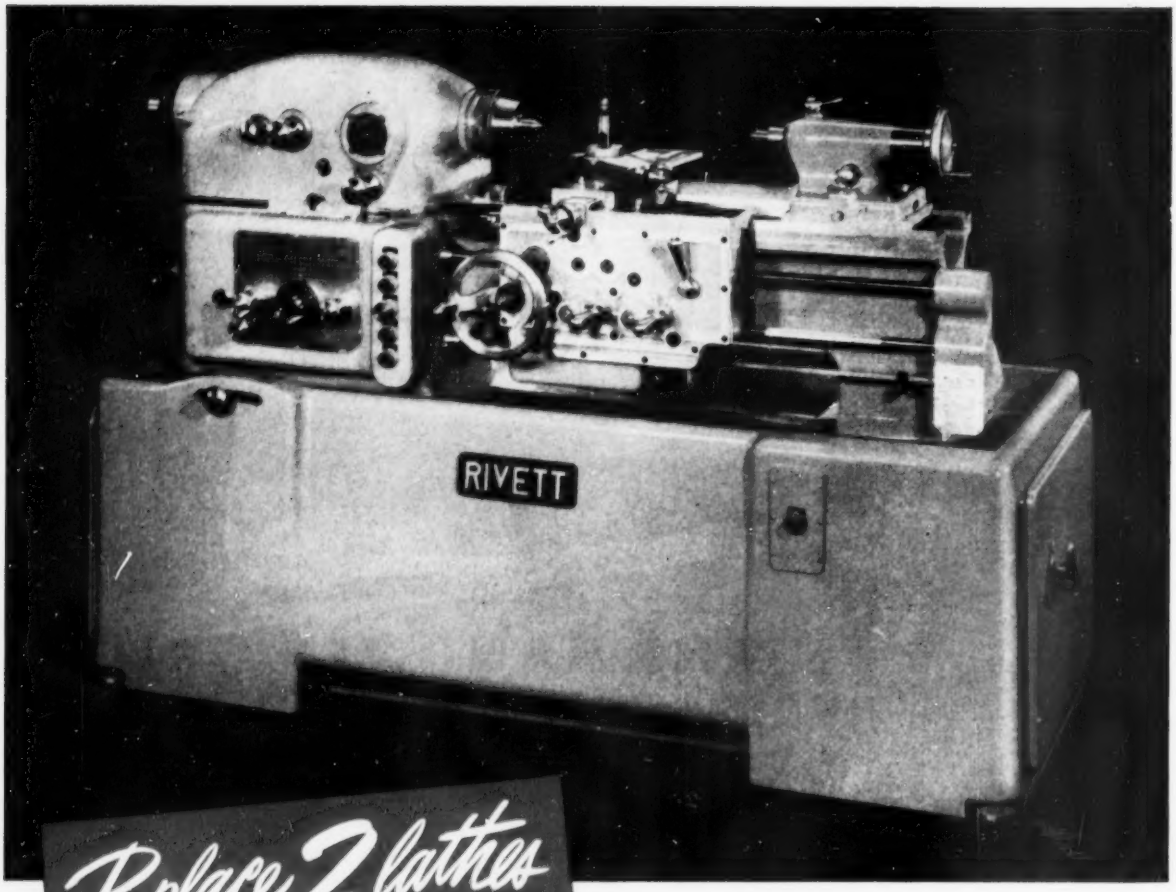


Replace 2 lathes in your shop

...with this new RIVETT 1020S TOOLROOM LATHE

RIVETT 1020S has what it takes to make an outstanding lathe!

■ 40% heavier than comparable lathes. Weighs 4000 lbs. ■ Back gearing for power cuts—belt drive for high speed. Range from 22 to 3600 R.P.M. ■ 12¾" wide hardened steel ways of bed absorb heavy cutting force. ■ High spindle speeds through mechanical drive. ■ Push button controls for complete operation. ■ Neutral clutch stops spindle without stopping drive. ■ Three bearing mounts for spindle. ■ Collets mount directly in spindle. ■ Hand wheel for turning headstock spindle. ■ Anti-friction bearings used throughout. ■ Gear box gives 72 feeds and 84 threads from 2 to 240 per inch. ■ Automatic lubrication. ■ Hardened and ground feed screws.

No need to have both an instrument lathe and an engine lathe when this new Rivett 1020S combines the features of both! Here you get feather-touch sensitivity at 3600 R. P. M.—or the ruggedness for a ¼" cut at .020" feed in cold rolled steel. It qualifies for any work within its 12½" swing and 20" centers.

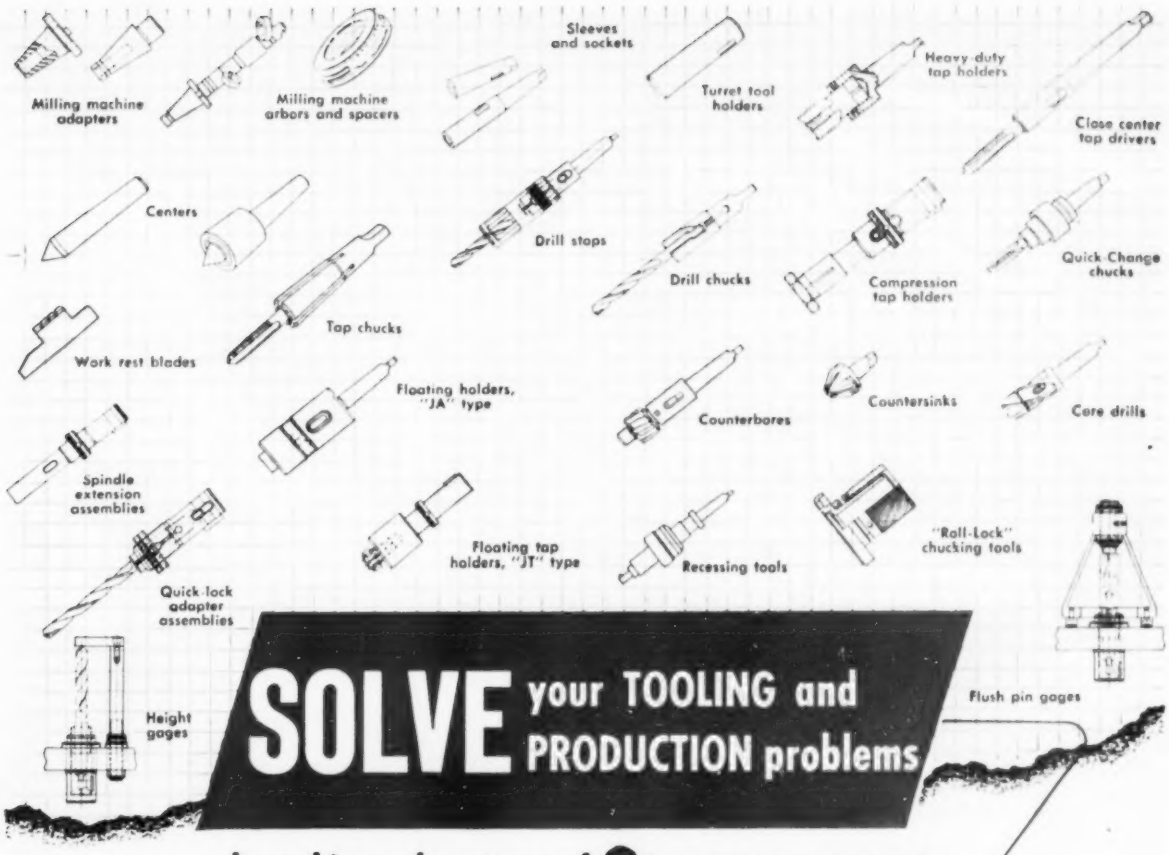
The beauty of this amazing machine will delight the heart of any tool man. Look at the features listed here and then *get all* the facts on what makes the 1020S the outstanding lathe investment. Write for Bulletin No. 1020A.

RIVETT

LATHE & GRINDER, Inc.

Dept. AMR6 Brighton 35, Boston, Massachusetts

For More Precision Work RELY ON RIVETT LATHES AND GRINDERS, The Master Craftsman's Master Tools



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Helping you solve your tooling and production problems, and get fast accurate production at low cost, is our first objective. Since 1912 we have been designing, developing and manufacturing standard and special tools to meet the exacting requirements of the metal-working industries.

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Let our engineers help you solve your tooling and production problems. An idea here, one there — originated from prior experience — often put us in a position to help you find a quick solution to your most perplexing problem.

You get the service desired because S-J Production Facilities have been further expanded.

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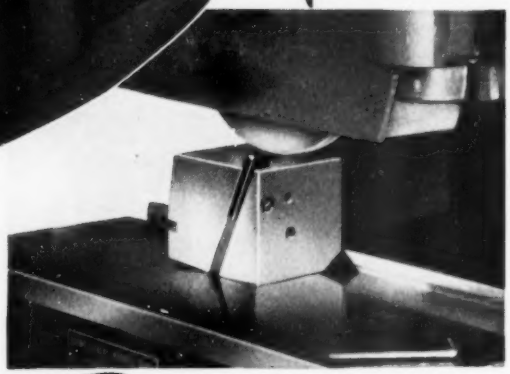
YOU GET LOW COST, FAST, ACCURATE PRODUCTION WHEN USING S-J TOOLS AND ENGINEERING SERVICE

Beaver

SOLID CARBIDE, INSERTED BLADE, MILLING CUTTERS OFFER MANY ADVANTAGES

Exploded view showing Beaver's simple, positive, blade locking system.



Beaver Blade-grinding fixture.

Beaver Blade-setting fixture.

The quality and fine workmanship of Beaver Milling Cutters are not the only reasons for their popularity. The Beaver system of fast, accurate, cutting-blade maintenance is a time and money-saver worth considering.

Beaver's simple, accurate blade-grinding fixture enables you to grind blades individually and uniformly on your own surface grinder. Beaver's system permits accurate sharpening for short-overhang set-up which means less breakage, longer blade life and less down-time for repair.

Individual sharpening means less blade loss per sharpening and more complete use of each blade. Extra sets of sharpened blades can be kept on hand for emergency use. With Beaver's, specially designed, blade-setting fixture you can easily install new blades quickly and accurately. The entire Beaver operation of removal, sharpen and reset cuts "in assembly" sharpening time in half.

See our Catalog 52 for cost reducing Beaver Tools

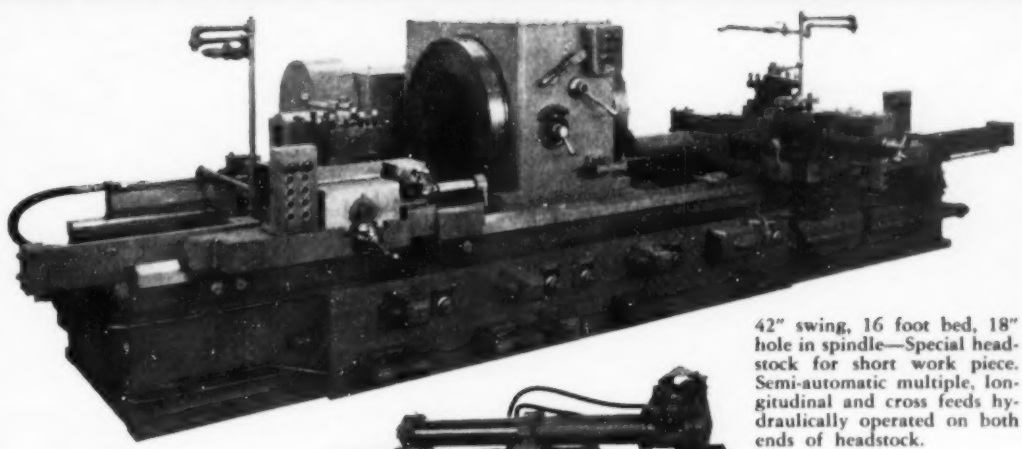
Beaver TOOL AND ENGINEERING CORPORATION

2850 ROCHESTER ROAD • BOX 429, ROYAL OAK, MICH., Teletype - Big Beaver 648

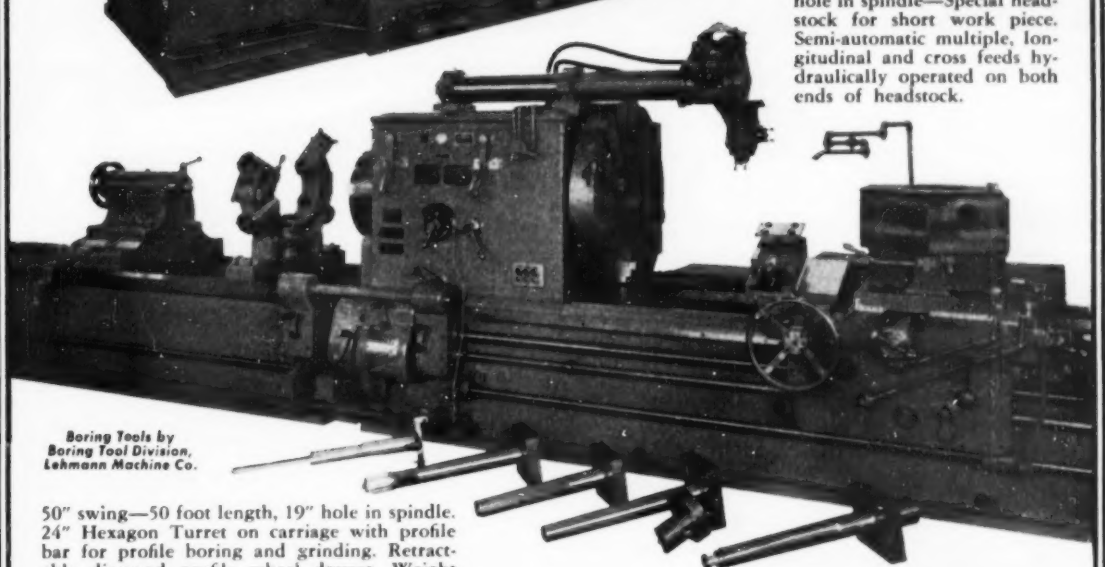
DOUBLE LARGE HOLE ENDER

LEHMANN *Hydratrol* LATHES

LARGE HOLLOW SPINDLE — DOUBLE END TYPE



42" swing, 16 foot bed, 18" hole in spindle—Special headstock for short work piece. Semi-automatic multiple, longitudinal and cross feeds hydraulically operated on both ends of headstock.

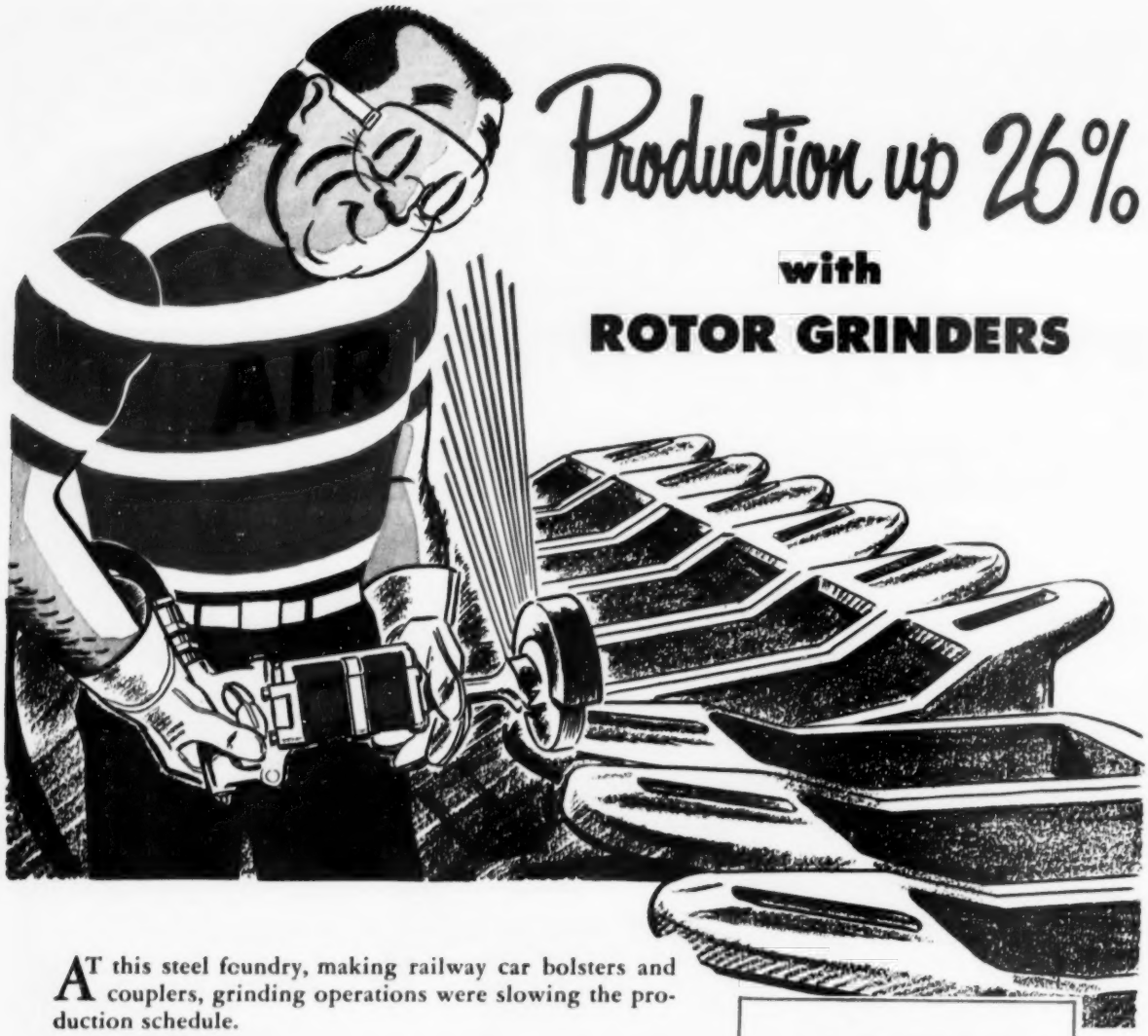


Boring Tools by Boring Tool Division, Lehmann Machine Co.

50" swing—50 foot length, 19" hole in spindle. 24" Hexagon Turret on carriage with profile bar for profile boring and grinding. Retractable diamond profile wheel dresser. Weight 72,000 lbs.

Double End Hydratrol Lathes are built in sizes from 18" with holes up to 7⅛" to larger sizes with holes to suit the job. Double End operations avoid necessity for resetting the work, and insure relative concentricity of boring and turning operations and squareness of faces at both ends.

Lehmann Machine Co.
DIVISION OF NOVO ENGINE CO.
CHOUTEAU AT GRAND
ST. LOUIS 3, MO.



Production up 26%

with ROTOR GRINDERS

AT this steel foundry, making railway car bolsters and couplers, grinding operations were slowing the production schedule.

PROBLEM: Need for more finished pieces per day. Reduction of high wheel cost. Reduction in "down time" of equipment for repairs. Formerly used 8", 13-pound grinders.

SOLUTION: Rotor Application Engineer recommended 6", 6,000-rpm Rotor Grinders. Weigh only 9¾ lbs.

RESULTS: Production stepped up 26%. Less operator fatigue. Wheels last longer. Finishes are better.

The Rotor Application Engineer can help *you* too. Call or write for Catalog #38.

ROTOR GRINDER FACTS

SPEEDS
3100 to 21,000 R.P.M.

WEIGHTS
4" grinder—8¾ lbs.
6" grinder—9¾ lbs.
8" grinder—11¼ lbs.

HANDLES
Straight or Spade.

AIR O'TOOL

AIR ® THE ROTOR TOOL CO. CLEVELAND OHIO ® HIGH CYCLE

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

INTRODUCING BEARCAT TOOL STEEL

Super Shock-Resisting ... Versatile, Too!

Here's a brand-new tool steel that we've been developing over the past several years. Proven in a wide variety of production tools and dies, Bearcat is a general-purpose steel especially suited for uses where shock-resistance, hot-work properties and easy machining are important.

Some of Bearcat's big features:

- Super shock-resistance
- Deep-hardening . . . in air
- Easy to machine (Brinell 197 max)
- Low distortion in heat-treatment
- Good hot-work properties
- Easily carburized for long wear

These are not just claims made for a new, untried steel! Bearcat has been thoroughly tested in applications such as rivet sets, hot gripper dies, punches, chisels, moil points, forming dies. All of the possible uses for Bearcat have not yet been explored, but we expect it to be ideal for hot headers, blanking dies, master hobs, machined-cavity molds, and many general-purpose tools and dies.

Bearcat is stocked in our mill depot and it's also available through your local Bethlehem tool steel distributor.

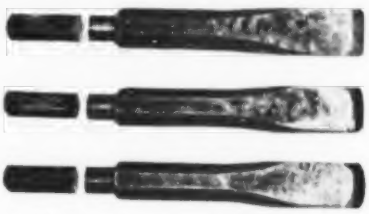
Typical analysis:

C	Mn	Si	Cr	Mo
.50	.70	.27	3.25	1.40

Complete data may be had by writing us for Booklet 341. Address your request to Room 1037, Publications Dept., Bethlehem Steel Co., Bethlehem, Pa.

BEARCAT DRIVES 27 TIMES MORE HOT RIVETS

Here's one example of what Bearcat can do on a job that calls for both shock-resistance and good hot-work properties. This typical rivet set, made from Bearcat, drove 43,094 rivets and was still in good condition. Rivet sets made from carbon tool steel, and used under similar conditions, drove an average of only 1566 rivets before recupping was required.



All of the chisels broke in service at the sharp change of section. While this is classed as a mechanical error, it does show how improper design can cause failure no matter how carefully a tool may be heat-treated.

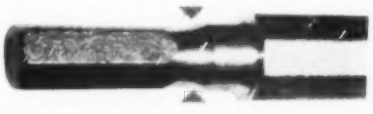
Chisel Breakage Cured by Undercutting Shanks

A large user of chisels — made from a top-grade shock-resisting steel, Bethlehem Omega — reported excessive breakage. One of our metallurgical sleuths soon put his finger on the trouble.

When the hexagon shanks were milled by the customer, a milling cutter was used which did not have an adequate radius. As a result, stresses were concentrated at the sharp change of section in the shank. Subjected to heavy impacts in air hammers, the chisels broke prematurely — and always at this portion of the shank.

The solution for the breakage was one that really surprised the customer. See photographs below.

This shank shows the "stress raiser," caused by the lack of sufficient radius, where the milled hexagon section meets the round section.



All of the unused chisels were salvaged by having an undercut ground on the shanks so that a ½-in. radius was provided at the source of the trouble. Despite the smaller section, these chisels gave good service. The sharp change in section was eliminated, stresses were better distributed.

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Many people don't realize that carburizing can be accomplished with the high-carbon, high-chromium steels — such as our Lehigh H, which contains 1.55 pct carbon and 11.50 pct chromium. The carburizing of tools made from such steels can be either helpful or harmful, depending upon whether the carburized case is produced intentionally or accidentally.

Tools intended for light loads and long service, such as lamination dies, are often intentionally carburized before quenching. Such dies have greatly improved resistance to wear because of the carbon added to the wearing surfaces. The usual procedure is to use carburizing compound as a packing medium and heat for the normal length of time at the quenching temperature.

Sometimes an accidental carburized case results when "spent" carburizer is used as a protective packing medium when heating for hardening. Spent carburizer is often almost as active as new carburizer. An accidentally produced carburized case is not always harmful. It may even be helpful. But there are many heavy-duty tools and dies that will develop chipped or spalled edges if they become carburized. When treating tools of this type, use cast-iron chips as a packing medium during hardening.

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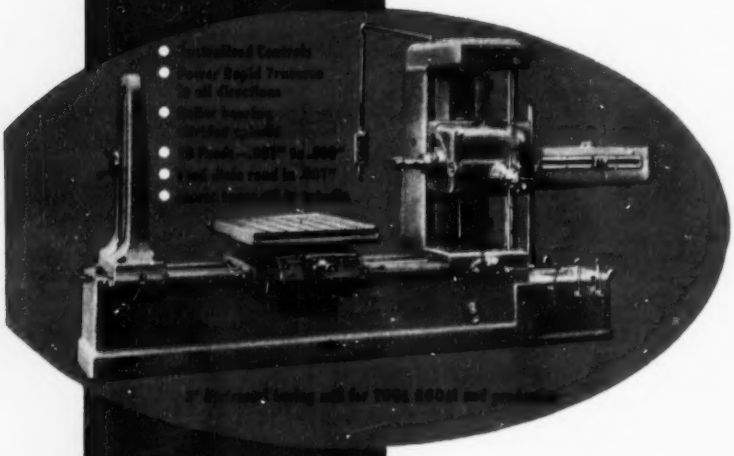

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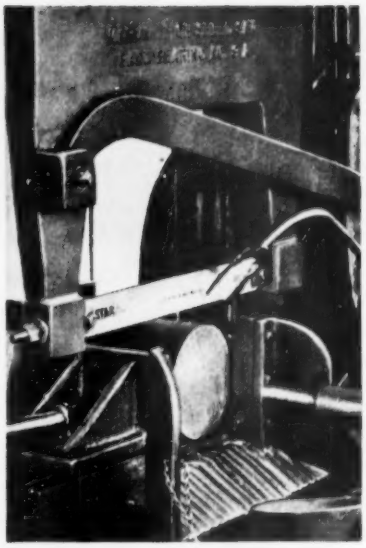

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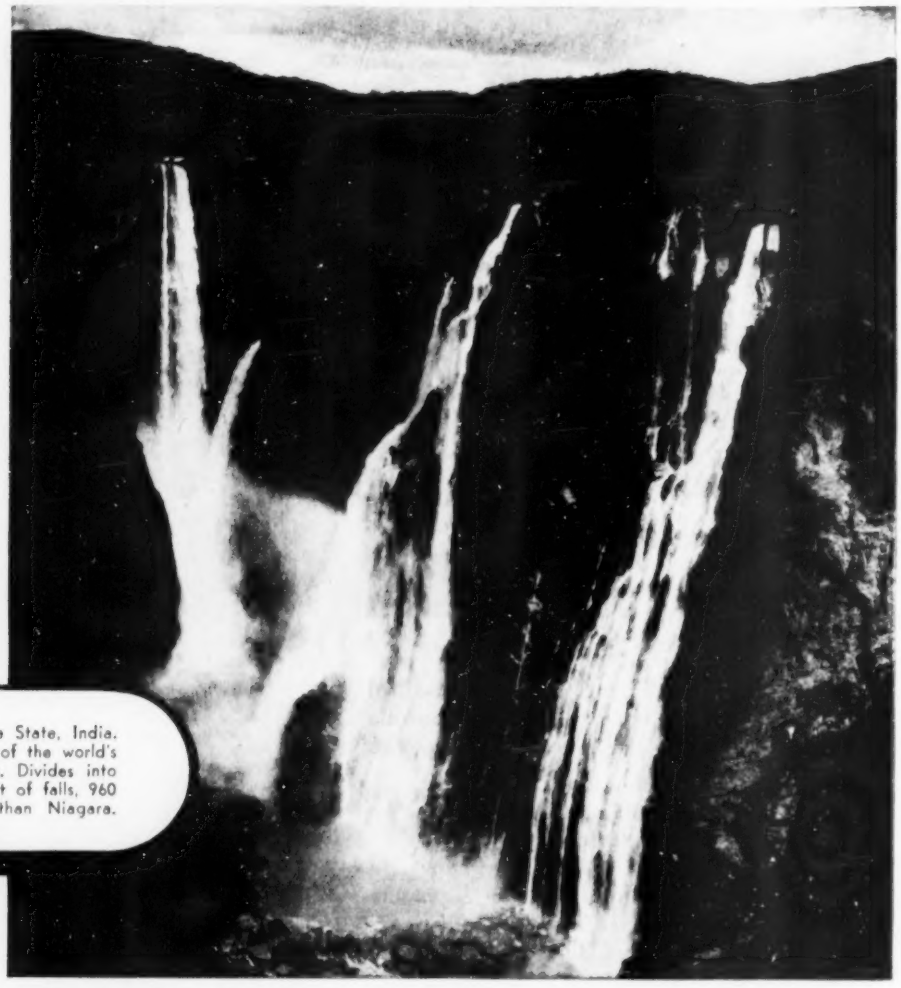

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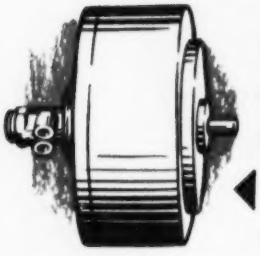

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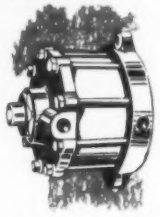

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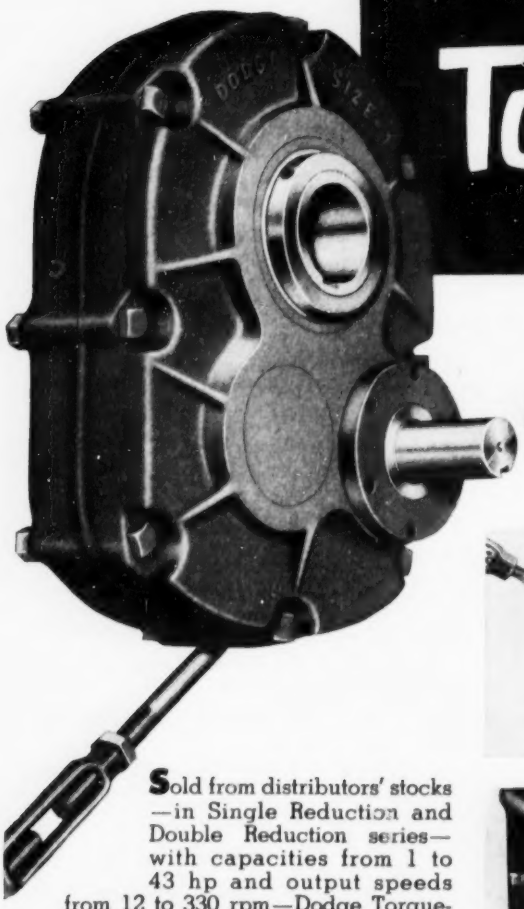

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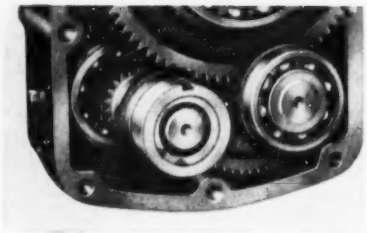

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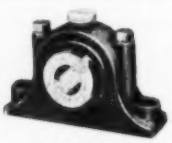

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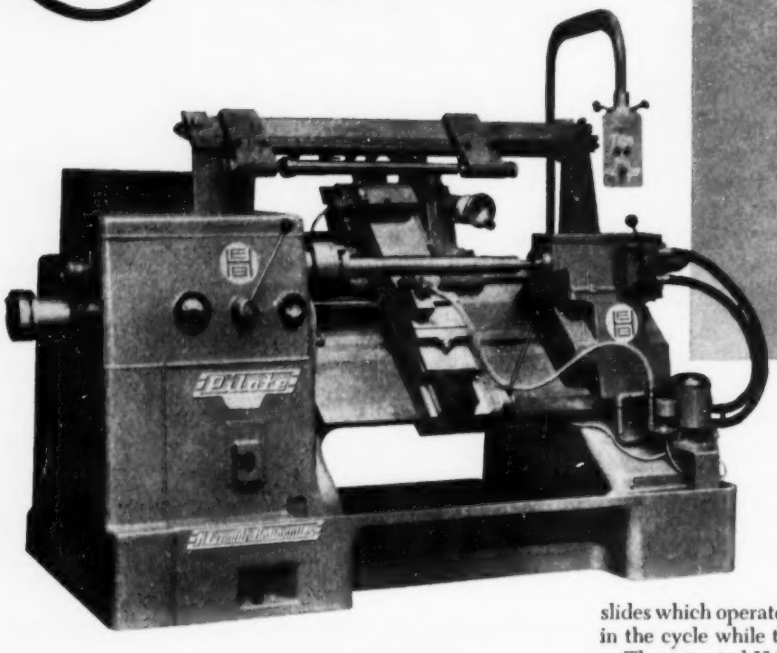

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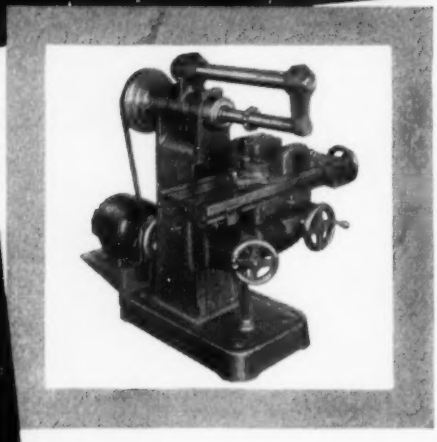

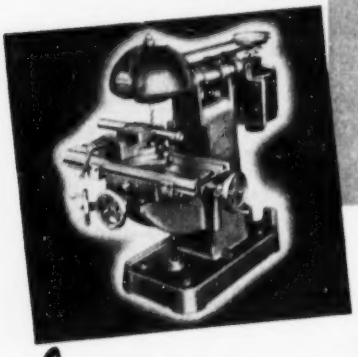

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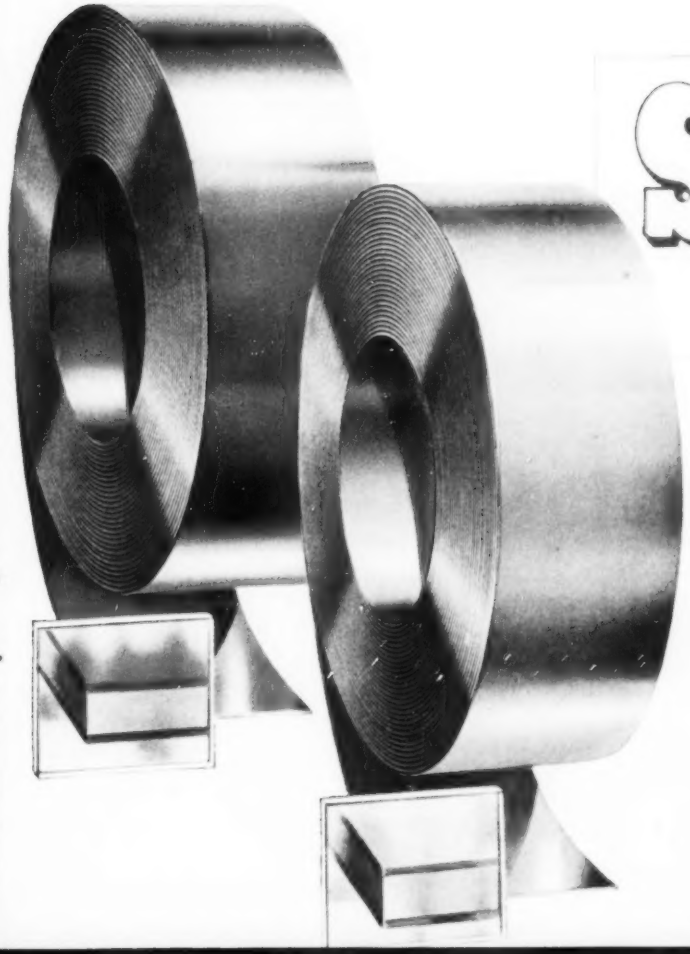

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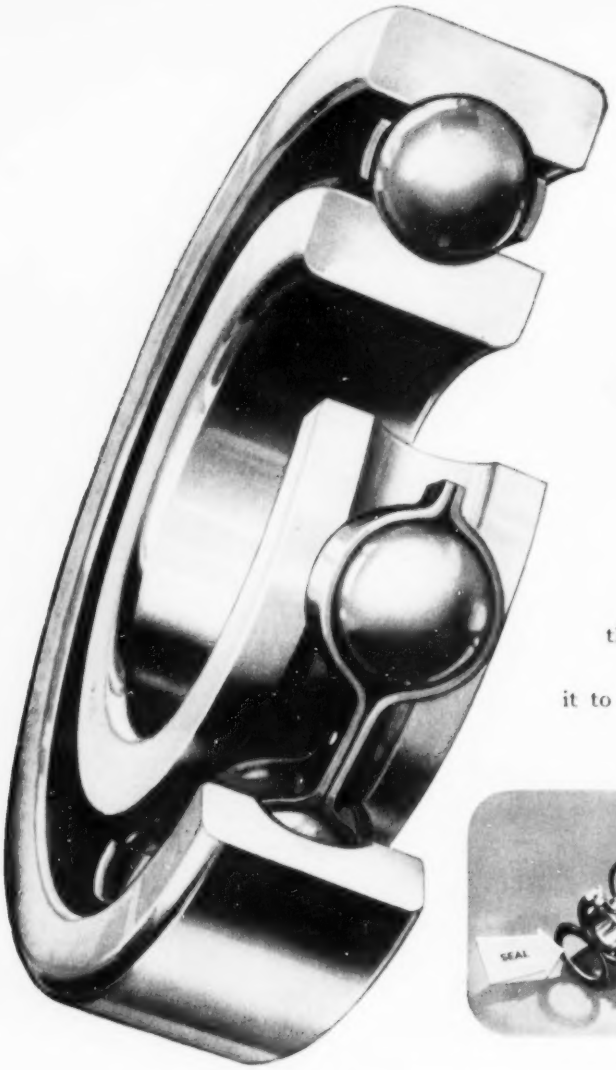

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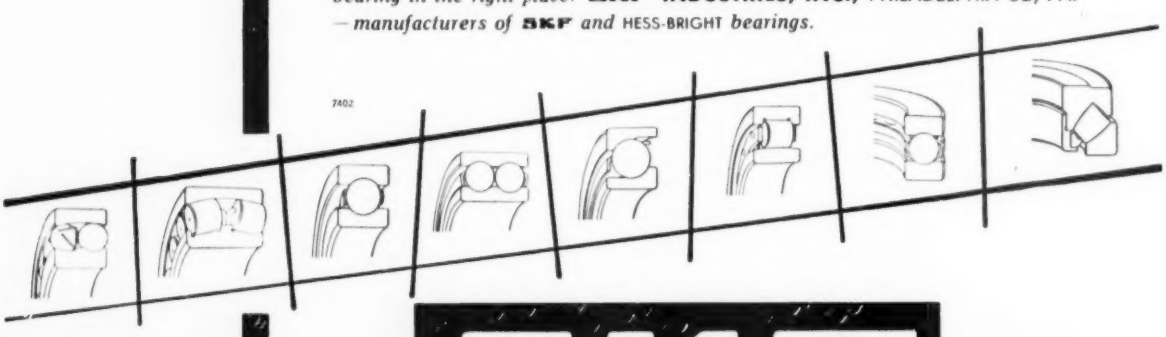
Look further—SKF Single Row Deep Groove Ball Bearings are available with *any combination* of DuPont Fairprene seals, shields and snap rings: shields for excluding dirt; seals for retaining lubricant; snap rings for holding the bearing in lateral position in its housing.

Like all SKF Bearings, they're held well within established tolerance limits, tested for radial runout, carefully cleaned, protected from rust, strongly packaged.

Many SKF bearings are serving industry everywhere because SKF's unmatched Field and Home Office engineering service helped product designers *put the right bearing in the right place.* **SKF INDUSTRIES, INC.,** PHILADELPHIA 32, PA. *—manufacturers of* **SKF** *and* HESS-BRIGHT *bearings.*

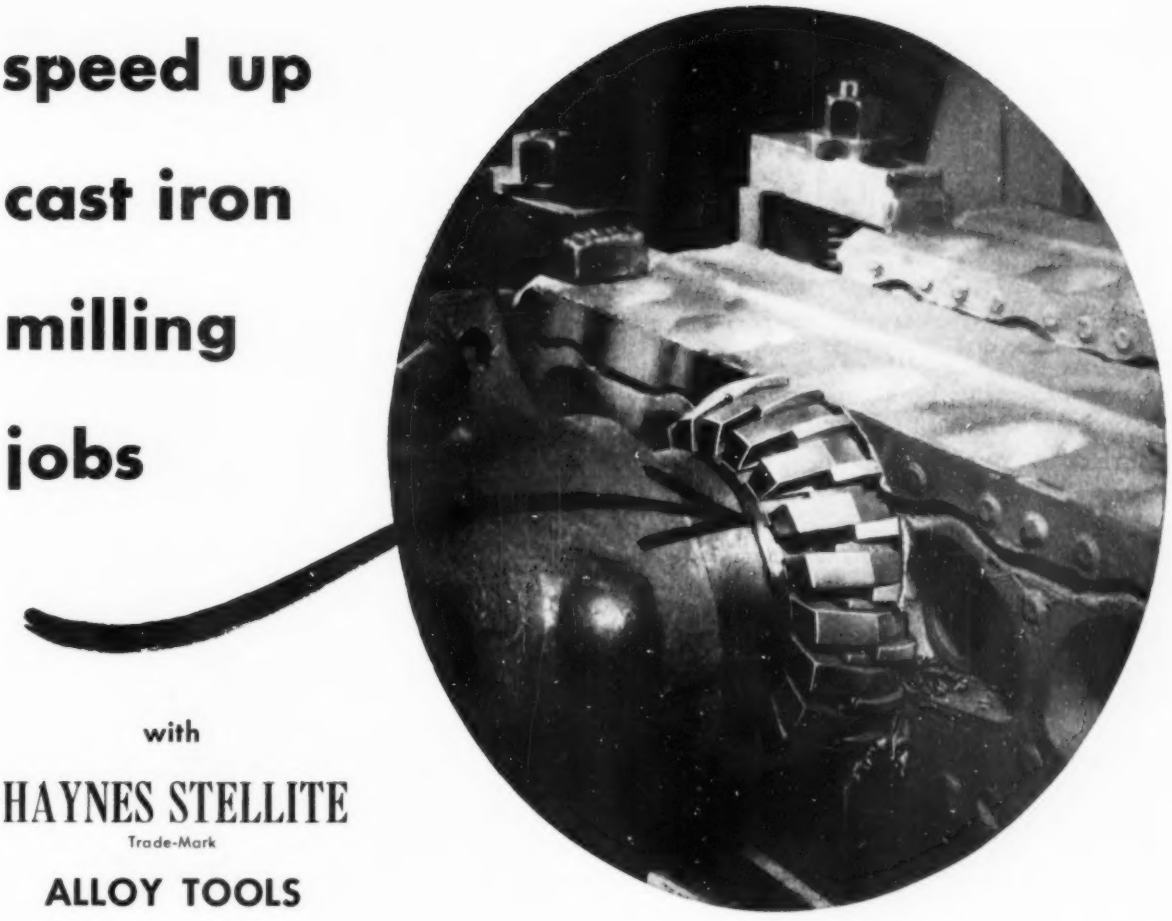
7402



SKF'S COMPLETE LINE OF ANTI-FRICTION BEARINGS, PLUS **SKF** ENGINEERING CO-OPERATION, HELPS YOU PUT *THE RIGHT BEARING IN THE RIGHT PLACE.*

SKF®
BALL AND ROLLER BEARINGS

speed up cast iron milling jobs



with

HAYNES STELLITE
Trade-Mark

ALLOY TOOLS

High compressive strength at cutting temperatures . . . good impact strength . . . and extremely low frictional coefficients make HAYNES STELLITE alloys ideal tool materials for cast iron milling jobs.

Two hard grades of HAYNES STELLITE alloy are available for milling cast iron at high speeds. On soft cast iron (less than 185 Brinell), these tools can take light milling cuts at speeds up to 300 surface ft. per min. For heavy milling, speeds up to 250 surface ft. per min. can be used.

Hard cast iron up to 240 Brinell can be milled at speeds as high as 200 surface ft. per minute. Safe chip loads range up to 0.025 in. per tooth.

Tougher grades of HAYNES STELLITE alloy are available for efficient milling of castings that have irregular contours, surface imperfections, or inclusions, or where there are variations in chill depth.

HAYNES STELLITE alloy tools are available as fabricated shell-end mills and as insert milling-cutter blades. The different grades of alloy can be used for a wide variety of milling conditions. If you wish help on your own particular milling problems, write to the nearest Haynes Stellite Company office.

For a copy of the new manual, "HAYNES STELLITE Metal-Cutting Tools," write to our General Offices.

HAYNES TRADE-MARK *alloys*

"Haynes" and "Haynes Stellite" are trade-marks of Union Carbide and Carbon Corporation.

Haynes Stellite Company
A Division of
Union Carbide and Carbon Corporation
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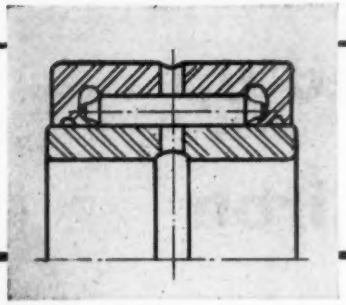
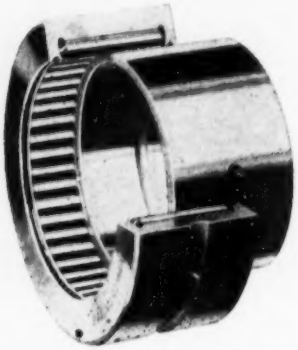
General Offices and Works, Kokomo, Indiana
Sales Offices
Chicago — Cleveland — Detroit — Houston
Los Angeles — New York — San Francisco — Tulsa

A bearing design of simplified construction reduces internal wear

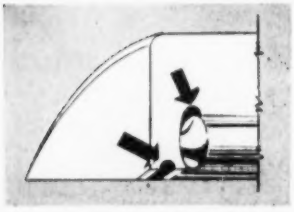


The performance efficiency and life expectancy of anti-friction bearings depends to a great extent on the ability of the bearing designers to hold internal wear to a minimum. They have found that wear can be materially lessened by reducing the number of bearing parts subjected to wear. In the case of MULTIROL SE Series roller bearings all parts have been eliminated except the anti-friction essentials of load carrying rollers and contacting races. Loose or welded in retaining rings and cages ordinarily found in roller bearings of this type have been discarded in the exclusive MULTIROL design.



Here rollers are retained by rolled over lips on end shoulders that are solid extended sections of the outer race. Cages are not required and other delicate parts that may wear, warp or break loose in mounting or in service are not needed. Numerous other advantages accrue from this MULTIROL bearing construction in addition to reduced internal wear and longer bearing life.

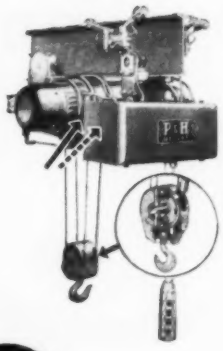
Lubrication Advantages

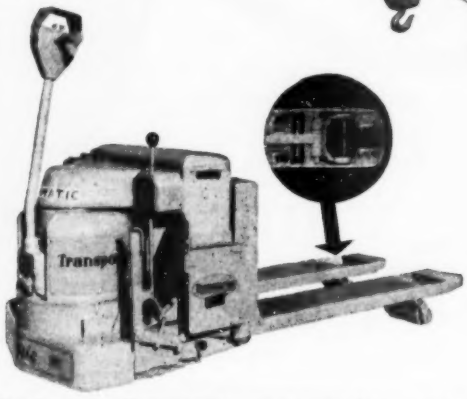


Important among these is the extra protection against destructive foreign particles provided in SE series bearings by a lubricant retaining groove, built into the inside diameter surface of the roller retaining end shoulder. The ring of lubricant held in this groove acts against the inner ring O. D., increasing the sealing effect of the precision tolerances between these shoulders and the inner race. Notice, too, the groove above the roller ends. Acting as a lubricant reservoir, this groove provides MULTIROL SE series bearings with an extra margin of protection against neglected or delayed lubrication.

Typical Performance

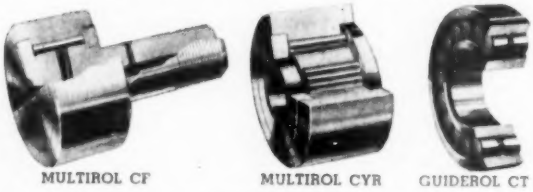
Harnishfeger P&H Hevi-Lift electric hoists carry up to 15,000 pound loads on MULTIROL SE series bearings. Their extra capacity and precision with ruggedness help reduce necessary radial bearing space in the upper and twin bottom sheaves. Two additional SE bearings add smooth efficient and dependable performance in the hoist transmissions.





The Automatic Transportation Company's Transporter uses eight Multirol SE Series bearings in the four rear wheels to carry 6000 pound capacity loads easily and freely. Wheels are mounted dual on each fork and two bearings with a center spacer support each wheel. These small but rugged bearings accommodate a large shaft with a comparatively small O. D. and materially reduce starting and rolling friction for finger-tip maneuverability of this heavy duty material handler.

Other McGILL® Bearings



MULTIROL CF | MULTIROL CYR | GUIDEROL CT

A new 140-page Bearing Reference Guide complete with 30 pages of vital engineering data has just been released by the McGill Manufacturing Company. It has the full story on the advantages of Multirol SE Bearings as well as information on the Multirol CF and CYR and Guiderol Bearings. Send now for your copy of McGill Catalog No. 52.

McGILL® — Precision Bearings

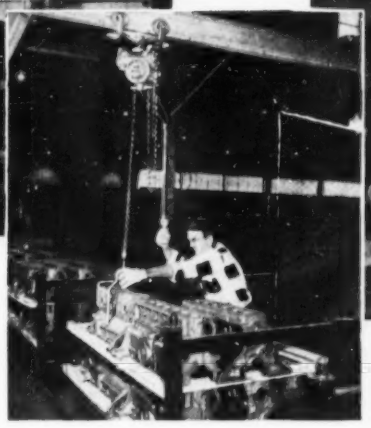
McGILL MANUFACTURING COMPANY, INC.
300 N. Lafayette Street, Valparaiso, Indiana

181 Air Hoists

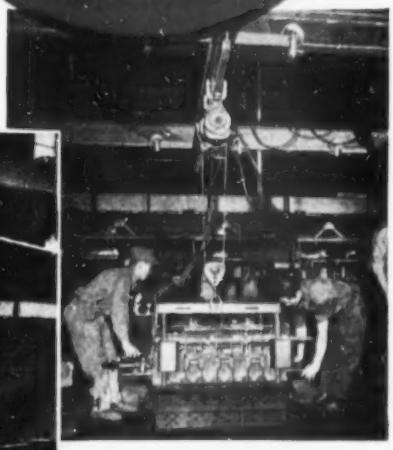
...selected by Cleveland FORD Foundry

Production lines equipped with Ingersoll-Rand Air Hoists

Closing the molds on the 6-cylinder block line with Size BN Hoists and Pendent Throttle.



End of the line . . . Size LC-2 Hoist with Pendent Throttle speeds the loading of 12 finished blocks on special skids.



The Pendent Throttle for controlling the Size BN Hoist is mounted on this special core setting fixture.

Why production men choose I-R Air Hoists

There are 58 sizes available. Lifting capacities range from 200 lbs. to 20,000 lbs.

PENDENT THROTTLE

The only complete line of air hoists with convenient "one-hand" control

● provides "Finger-tip" control over full range of speeds

POINTS OF SUPERIORITY

- **VARIABLE SPEED**—Lifting power ranges from a smooth creep to full speed.
- **OVERLOAD FACTOR**—Air motors cannot be damaged by overloading. More horsepower per pound of weight.
- **SMOOTH CONTROL**—A single rotary valve eliminates jerks and provides the exceptionally smooth power.
- **AUTOMATIC BRAKE**—A positive brake holds the load even though the air supply should fail.
- **POPPET TYPE THROTTLE VALVE**—Prevents air leakage when the hoist is idle.
- **SPOOL DRUMS**—Furnished in place of grooved drums where extra lift is desired.
- **LOW MAINTENANCE**—I-R hoists are universally recognized for their reliability and low maintenance.

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849-B

Apex INSERTED-BLADE METAL-CUTTING TOOLS *At Work For*

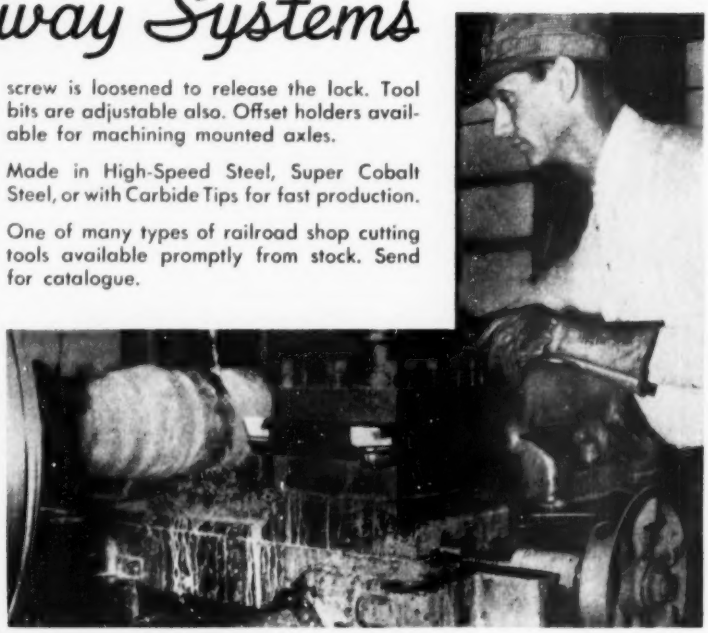
Southern Railway Systems

AT THE RIGHT: Standard "Apex" Carbide Tipped tools are being used by Southern Railway Systems for high-speed re-dressing of journals. These tools are made with ¾—⅛" radius both right and left.

BELOW: These "Apex" Shankless Serrated Tools for axle or journal turning are used in either single or multiple tool posts. Only the bit has to be changed, as a single rear screw is loosened to release the lock. Tool bits are adjustable also. Offset holders available for machining mounted axles.

Made in High-Speed Steel, Super Cobalt Steel, or with Carbide Tips for fast production.

One of many types of railroad shop cutting tools available promptly from stock. Send for catalogue.



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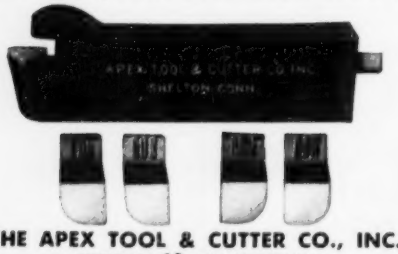
Atlantic City, June 22-27—Booth LH 2 & 4



THE APEX TOOL & CUTTER CO., INC.
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CHAMPION
E-X-P-A-N-D-I-N-G
MANDRELS

Precision Model

Standard Model

give *speed* to every set-up

The flexible sleeve, mounted on tapered arbor, expands automatically to fit the hole. Inserted by hand—no arbor press needed. Always an exact, positive, concentric fit. Locked by a single mallet blow. Unlocked the same way. CHAMPION Expanding Mandrels are used in machine shops around the world. Save time, cut production costs, whether the job calls for machining one piece or a thousand.

Precision Model has expansion range of .010". Available in regular sizes to fit holes from ⅛" to 3" diam. Holds work to tolerances of .0002" run-out. Guaranteed for precision grinding, turning and milling operations.

Standard Model maintains close tolerances, handles material of any length bore, hard or soft metals—from thin tubes and bushings to heavy castings and forgings. A set of fourteen will fit every hole from ⅛" to 9½" diam.

CHAMPION *Expanding Mandrels can be made in special shapes and sizes to fit any specifications. Quotations on request. Write for descriptive folder today.*

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Dept. 24 **Springfield, Ohio**

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RIVETERS — PIONEERS in their line—head rivets from smallest to ¾" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method—Sizes to meet all needs—Types include Vertical and Horizontal Multiple Spindles.

Write for literature and don't forget to send samples.

THE GRANT MFG. & MACHINE CO.
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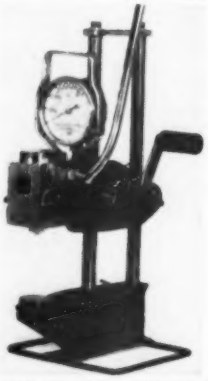
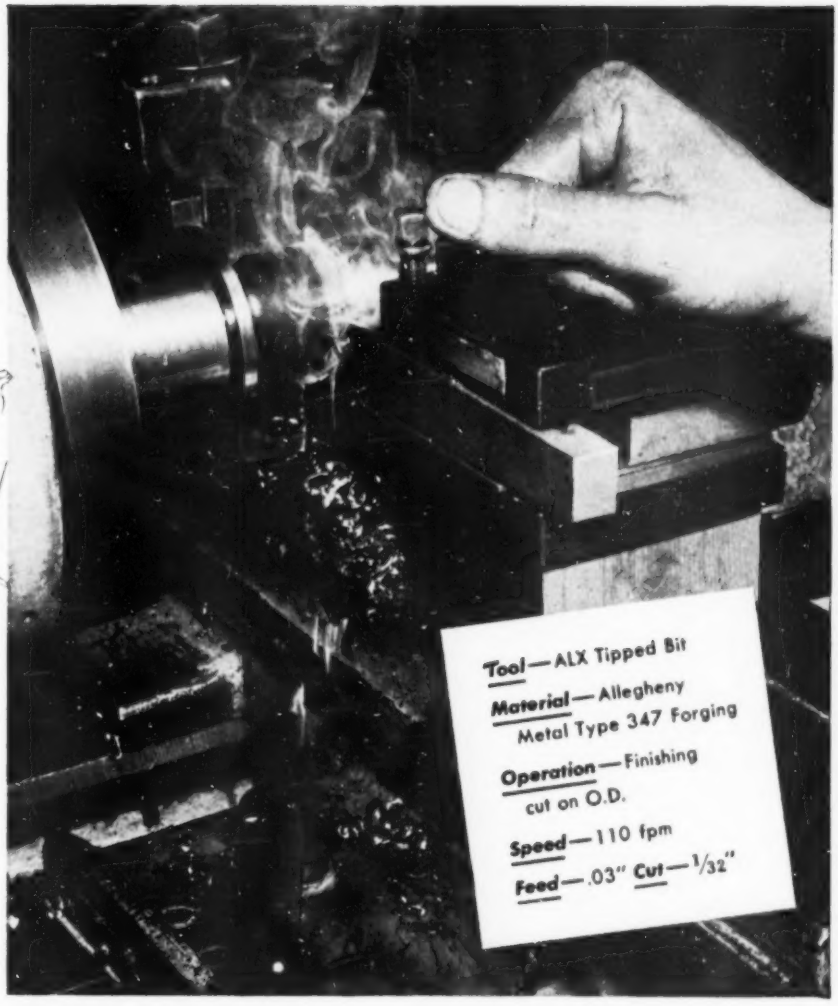
KING PORTABLE BRINELL HARDNESS TESTERS FOR ALL BRINELL TESTING

Puts an actual load of 3000kg on a 10mm ball.
Throat, 4" deep.
Gap, 10" high.
Weight, 27 lbs.
Test head removable for testing large parts—castings, forgings, etc.
Equally accurate as portable or stationary equipment.
Can be used in any position—even upside down.



ANDREW KING
Box 606 J **Ardmore, Pa.**

Want Faster Cutting? Fewer Grinds?



. . . then get ALX ALLOY Cutting Tools

Write for copy of

"ALX ALLOY TOOL BITS"

An eight-page booklet tells how you can effect production economies by using ALX for fast turning, boring, and facing—in certain applications. Helpful information includes grinding, tool angles, speeds and feeds, brazing of tips. *Write for your copy.*

ADDRESS DEPT. AM-42

Many a machine shop—and probably yours—has jobs on which ALX Tipped Tools or ALX Solid Bits step up production by permitting increased speeds, feeds, and depths of cut. Resharpening is less frequent, the reason being special composition.

ALX is a cast-to-shape, non-ferrous, cobalt-base alloy containing chromium, tungsten, carbon, and boron. The as-cast hardness of 60-62 Rockwell C obviates later heat treatment. Tools stay sharp at accelerated speeds and higher temperatures. Speed range is above that of high-speed steel, but lower than with carbide. At such intermediate speeds, the superior performance of ALX results from toughness, red-hardness, edge-strength, and abrasion-resistance values combined.

An Allegheny Ludlum tool engineer can quickly point out the strategic spots to tool up with ALX. For this service, call A-L. ● *Allegheny Ludlum Steel Corp., Forging & Casting Division, Wanda & Jarvis Aves., Detroit 20, Mich.*

For complete **MODERN** Tooling, call

Allegheny Ludlum

W&D 3465

AL
FINE TOOL STEELS
SINCE 1854

Vertical adjustment rapid and sensitive.
Built-in motor an integral part of wheel head.
Hand wheels of good size, conveniently located.
Wearing surfaces easily lubricated.
All scraped ways fully protected against grinding dust.
Hand feeds eliminate all moving parts except spindle.

ABRASIVE No. 1½ Toolroom Surface Grinder

Little Grinder with Big Ideas

Give your toolmakers the grinder that's big enough for most toolroom jobs. Abrasive No. 1½ takes work up to 15" long x 10" wide x 12" high — 150 sq. in. of table working surface! Nearly 50% more than most small surface grinders. Work produced on this grinder satisfies every requirement for accuracy, fine finish, and flatness. This is a precision tool of extremely simple design — a popular tool wherever one-of-a-kind jobs have to be ground fast, efficiently, and with a minimum of fuss and bother. Send for catalog describing Abrasive No. 1½ Surface Grinder. Abrasive Machine Tool Company, 8 Dunellen Road, East Providence 14, Rhode Island.

ABRASIVE
ACCURACY BOOSTS PRODUCTION

Abrasive Quality is Reflected in the Finish of Your Product

NEED AN INCLINABLE?

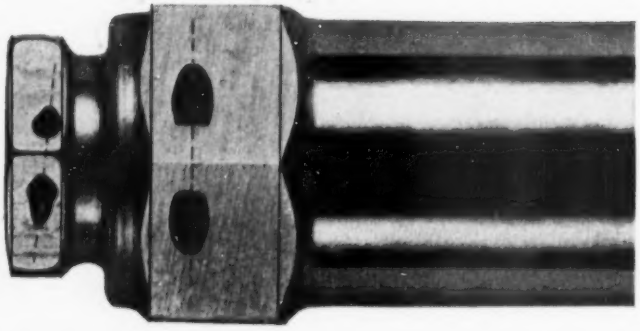
FERRACUTE

10 sizes - 6 to 200 tons

MAKE IT A FERRACUTE!

Since 1863 Manufacturers of Power Presses & Special Machinery. FERRACUTE MACHINE CO., Bridgeton, N.J., U.S.A.

Is this troublemaker causing headaches in your shop?



(Note that the cross hole drilled on the part to the left—without preliminary spot facing—is on an angle and is not parallel with the face of the part. Further, neither side of the drilled hole is clean. Now compare it to the straight, clean hole on the right, drilled after spot facing.)

Getting the answers to fabricating problems like this is part of doing business with Carpenter!

Isn't it worth a lot to know that the Carpenter Stainless you order is backed by a competent field engineering service to make Stainless fabricating better, easier, more economical? That's the way Carpenter likes to do business! It's one of the surest ways you have to get Stainless fabricating results you've always wanted.

And along with this helpful service, Carpenter brings you the finest Stainless money can buy. Originating in the same mill that invented the first Free-Machining Stainless, it means Stainless that feeds through your machines the same today, tomorrow and a year from now. So for really dependable Stainless backed by helpful shop service, get in touch with Carpenter. THE CARPENTER STEEL CO., 109 W. Bern St., Reading, Pa.

DRILLING CROSS HOLES

Recognize this common troublemaker? It involves drilling cross holes through angular sides of a hexagon head. Some shopmen tell us this job invariably causes them grief from the standpoint of high drill breakage and excessive wear on drill bushings resulting in poorly drilled holes. So one of our stainless service engineers recommended this easy cure: Before drilling, spot face where the drill enters the work. A simple spot facing fixture will do it. In this case the customer's fixture for drilling was O. K. for spot facing and the only tool needed to do this job was a drill ground with a flat end or a regular spot facer. If holes must be exceptionally clean, both sides should be spot faced.

Export Department: The Carpenter Steel Co., Port Washington, N.Y. —"CARSTEELCO"

Carpenter STEEL

Free-Machining Stainless

takes the problems out of production

Call your nearest Carpenter Mill-Branch Warehouse, Office or Distributor

these companies precision-punch parts in small lots with low cost tooling on

WIEDEMANN TURRET PUNCH PRESSES

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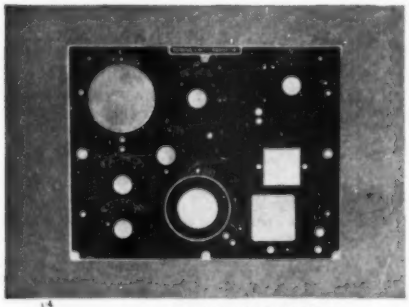

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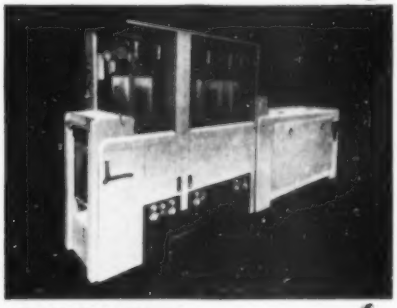

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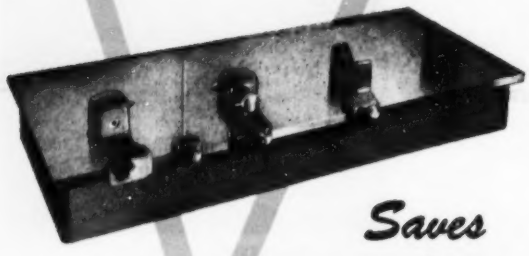
V-LINER (PATENTED) INSPECTION UNIT

A new, universal inspection device which integrates all of the normal requirements of the Inspection Department



Saves

space, man-hours, tool investment.

BASIC UNIT INCLUDES: (1) a 60" surface plate; (2) an exclusive, concentricity checking attachment; (3) adjustable bench centers; (4) V-blocks; (5) sine plate; (6) indicator attachment. All are self-aligning and quickly adjustable or removable. Specifications and tolerances meet finest precision standards. Savings in space, man-hours and tool investment are substantial.

Write for Bulletin V-1

The V-Liner Inspection Unit incorporates, all of the skill, precision and experience gained by Swanson in more than a third of a century of designing and building special automatic machines. Swanson machines have reduced costs, increased output and improved precision in hundreds of manufacturing operations.

. . . other PRECISION PRODUCTS by SWANSON

V-Liner Concentricity Checking Fixtures
V-Liner Holding Fixtures
Turret Index Units
Memory Devices for Automatic Machines
Feeding Hoppers and Positioning Devices
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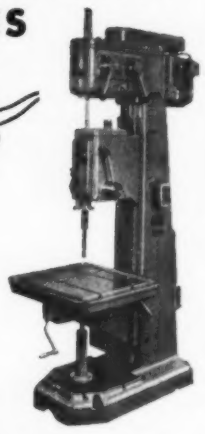
Engineers and builders of special, precision machinery

SWANSON
TOOL & MACHINE PRODUCTS INC., ERIE, PA.

Quality since 1919

ALFING HEAVY-DUTY DRILL PRESSES

Price Complete $1985
Delivery from Stock



Quick changeover from job-to-job on short or long run heavy-duty drilling production is assured by easily adjustable head and table on new ALFING DRILL PRESS.

Crank *raises* or *lowers* table; headstock moves 6" up or down by hand on scraped ways. Easy-to-reach controls cut handling time, too. 9" quill-supported spindle stroke, driven by 5½ h.p. V-belt motor. Motor speed 900 rpm. Drilling capacity of 1" in steel; 1¼" in cast iron. 8 spindle speeds from 150 to 1640 rpm. Drilling feed by hand or power.

Table surface 26"x28". Scraped base plate may be used as table for extremely bulky work pieces. Distance between spindle and table, 23" max.; spindle and base plate, 25"-40". Write for descriptive literature.

Engineered servicing and stock parts within 48 hours from Orban Service Centers in Newark, Detroit, Cleveland.

KURT ORBAN COMPANY, INC.

205 East 42nd Street, New York 17
Branch offices and distributors from coast-to-coast

KEYSEATING The Modern Way

Illustration shows typical set-up for cutting taper keyways with table tilted.

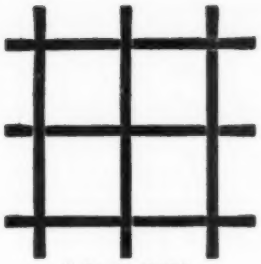
Machines are made in three sizes for keyways 1/16" to 1" in width.

Great simplicity and ease of operation of Davis Keyseaters assure the user of accurate, time saving work.

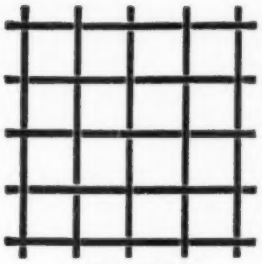
Let our engineer study your keyseating problems.

DAVIS KEYSEATER COMPANY

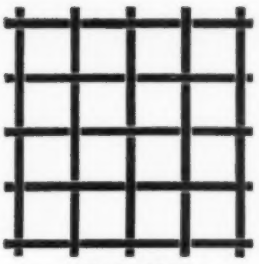
403 EXCHANGE ST. ROCHESTER, N. Y.



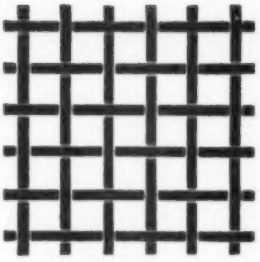
2 Mesh .063"
76.4% Open Area



3 Mesh .041"
76.7% Open Area

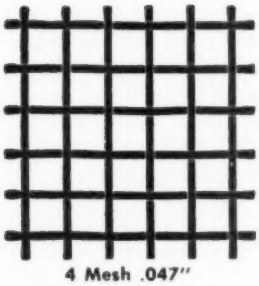


3 Mesh .054"
70.1% Open Area

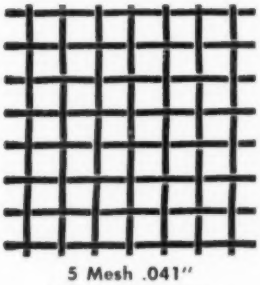


4 Mesh .063"
56.0% Open Area

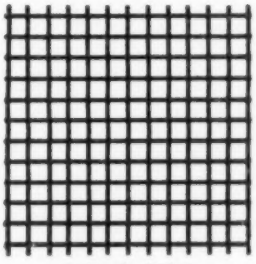
CALL CHASE



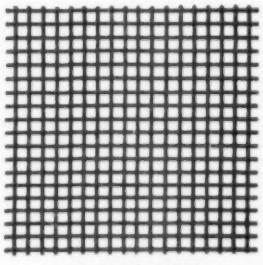
4 Mesh .047"
65.9% Open Area



5 Mesh .041"
63.2% Open Area

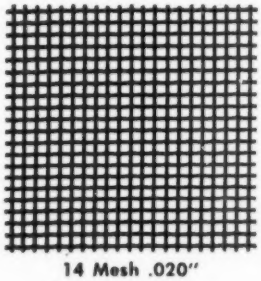


8 Mesh .028"
60.2% Open Area

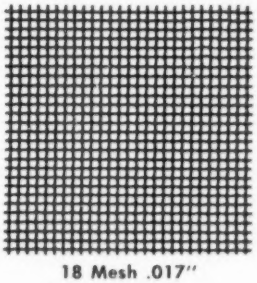


12 Mesh .023"
51.8% Open Area

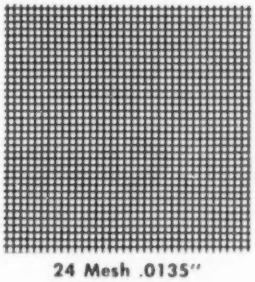
FOR INDUSTRIAL WIRE CLOTH



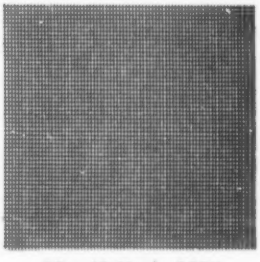
14 Mesh .020"
51.0% Open Area



18 Mesh .017"
48.3% Open Area



24 Mesh .0135"
45.8% Open Area



50 x 40 Mesh .009"
35.7% Open Area

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Baltimore	Cleveland	Houston	Milwaukee	New York	Rochester†	Waterbury
Boston	Dallas	Indianapolis	Minneapolis	Philadelphia	St. Louis	(Sales office only)

Eclipse-Pioneer* triples balancing output of air-pump rotors with TREBEL BALANCER

Rough balancing increased from 3.1 to 9.6 per hour
Fine balancing increased from 3.15 to 13.1 per hour

*Division of Bendix Aviation Corporation

Locate unbalance in your rotating parts this fast, simple way

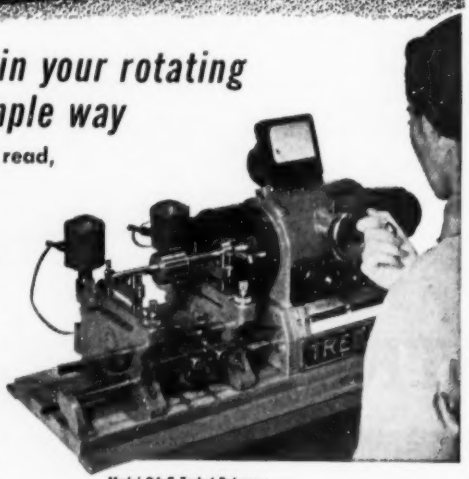
Takes less than a minute to read, 2 minutes to set up.

No special skills are needed to detect the *unbalance* that causes *vibration* in rotating parts . . . when you use the TREBEL DYNAMIC BALANCER.

The unique TREBEL dynamic balancing principle applies a variable counter-vibration to counteract unbalance vibration. Direct readings in ounce-inches give the *amount* of unbalance without further calibration; readings in degrees show *location* of unbalance.

That's why so many leading plants use the TREBEL.

Write for Catalog "A" or see a demonstration in your own plant.



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Max. work diameter 7"; length 18"
Accurate within .000025" displacement of center of gravity
Other Trebel models for work up to 22,000 lbs. and 98½" OD.

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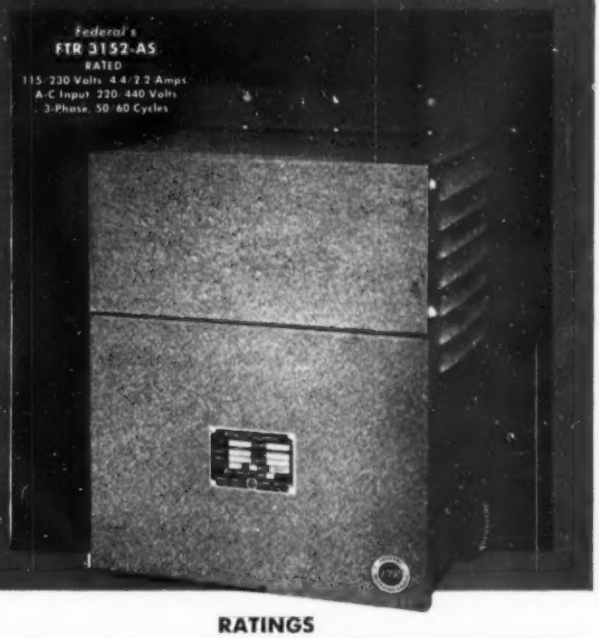
famous for steady, long-life industrial power supply



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FTR 3117-HS	115	1	50/60	115	10
FTR 3117-JS	230	1	50/60	115	10
FTR 3152-AS	220/440	3	50/60	115/230	4.4/2.2
FTR 3153-AS	220/440	3	50/60	115/230	6.6/3.3
FTR 3154-AS	220/440	3	50/60	115/230	8.8/4.4
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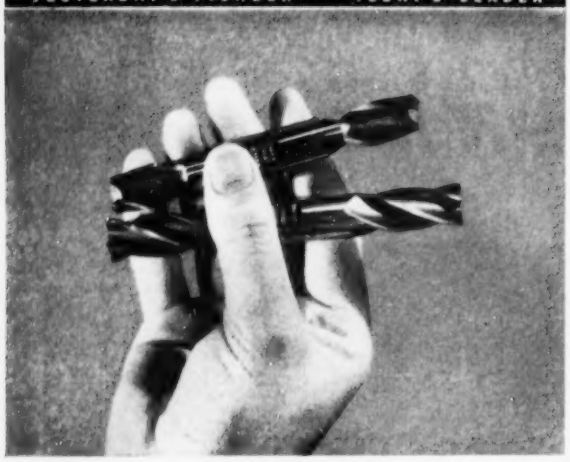

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Mac-it is geared for either large or small run production of screws with special design or strength characteristics.

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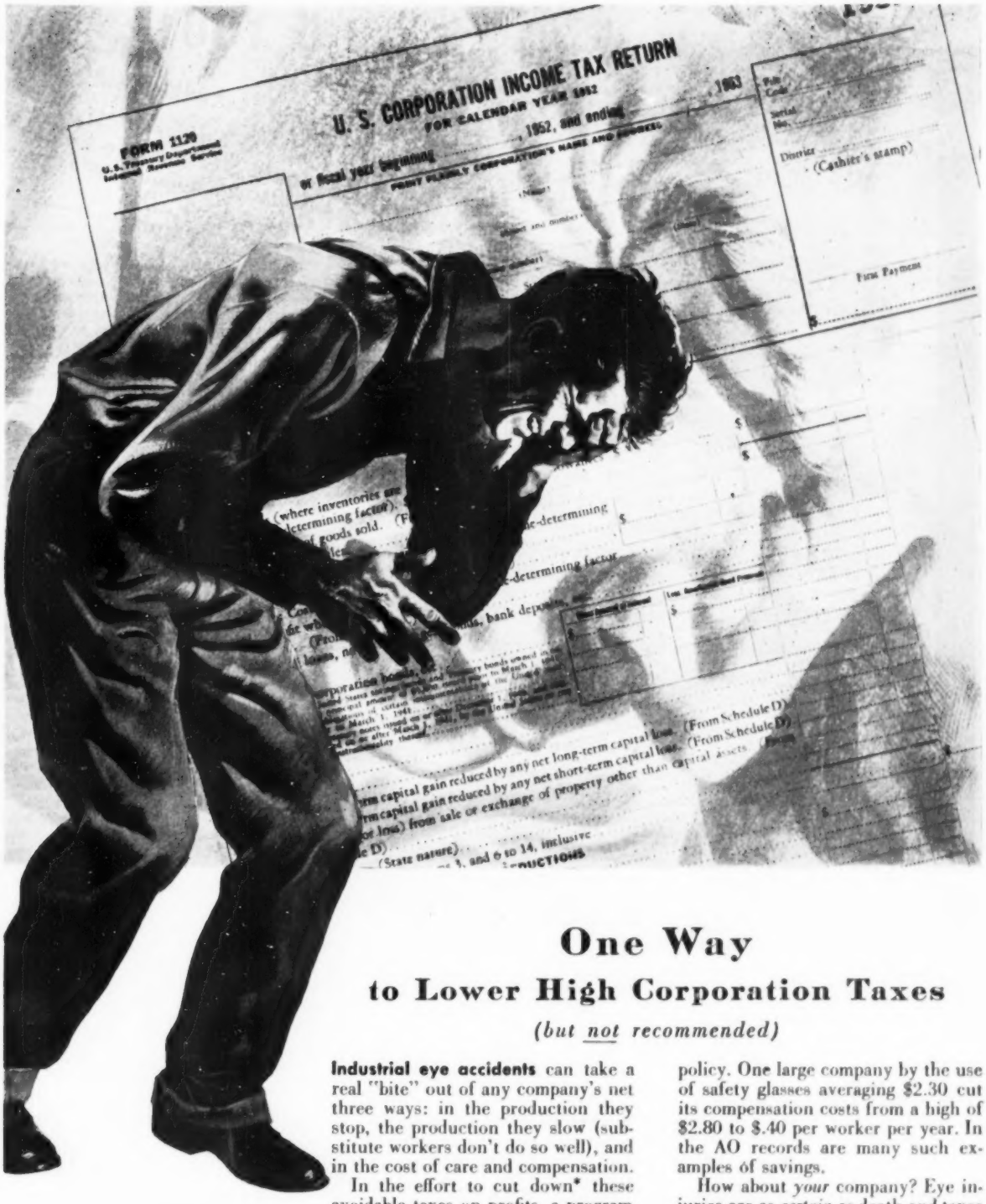

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Industrial eye accidents can take a real "bite" out of any company's net three ways: in the production they stop, the production they slow (substitute workers don't do so well), and in the cost of care and compensation.

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*98% of eye injuries are eliminated when workers wear safety goggles.

AO's *Industrial Vision Program Increases Production, Decreases Accidents.* Write today for booklet "Improved Industrial Vision" to American Optical Company, 5136 Vision Park, Southbridge, Mass.

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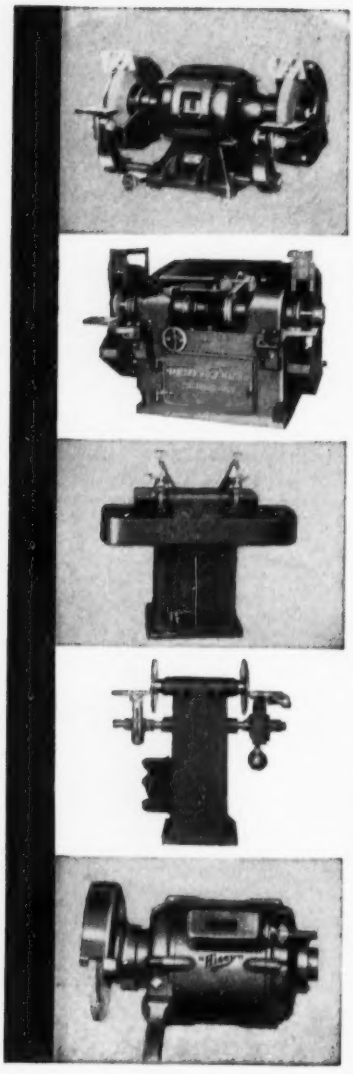

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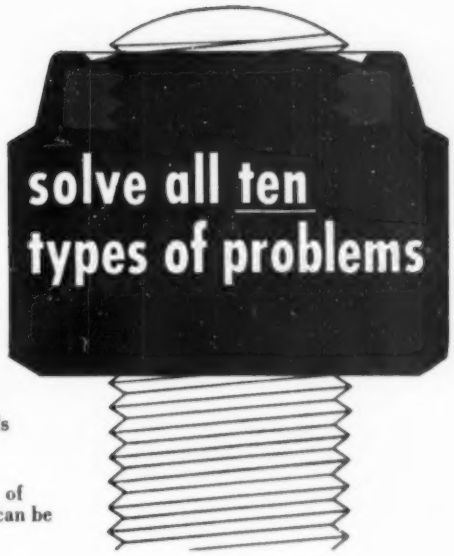
SABOTAGE is a greater potential danger for most plants than bombing. Have you taken any precautions to guard against it?

MORALE isn't built in a crisis; it's built beforehand. The crisis only tests it.

THERE'S an old saying that "If you want to be big, you've got to look big." Nobody likes a fourflusher or a fop, but everybody has been trained from childhood to expect a leader to look like one. Company policy can't earn respect on the major things either, if it is small on the minor things. Don't make your company look small.

elastic stop nuts solve all ten types of problems



Here are ten typical fastening problems. One device, the ELASTIC STOP nut, solves them all—without additional parts or operations. Deliberately undersized in relation to bolt diameter, the red elastic collar grips the bolt with a perfect fit, exerting a continuing self-locking pressure against the threads, and holding the nut securely in place at any point on the bolt. It also provides a tight seal against the bolt threads, which prevents seepage and wear-producing axial play. And because the bolt threads are protected against moisture from without, the nuts are not "frozen" to the bolt by corrosion.

ELASTIC STOP nuts stay tight, right where you put them, in spite of vibration and stress reversals. Yet they are not jammed in place, and can be removed with a wrench and reused many times.

For further information on ESNA self-locking fasteners, mail the coupon below.

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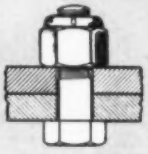
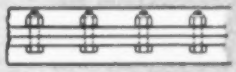


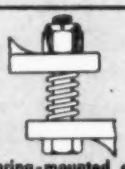
Wherever a vibration or impact proof bolted connection is desired.

On all electrical terminals subjected to vibration in transit or operation.

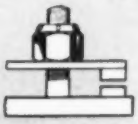


For uniform and precise prestressing of multiple bolt assemblies . . . adjusted by predetermined wrench torques.

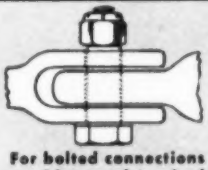
LOCATED ANYWHERE ON THE BOLT



Spring-mounted connections or dynamic balancing, where nut must stay put yet be easily adjusted.



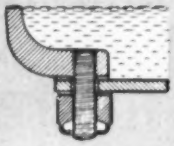
On make-and-break adjustment studs where accurate contact gaps are required.



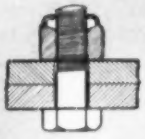
For bolted connections requiring predetermined play.

For rubber-insulated and cushion mountings where the nut must not work up or down.

FOR MANY SPECIAL APPLICATIONS



To seal bolt threads where elimination of leakage past stud threads is necessary.



To seal bolt threads where it is necessary to protect them from corroding elements.

To obtain delicate adjustments for applications such as bearing locknuts where precise adjustment is essential.

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☐ Elastic Stop nut bulletin ☐ Here is a drawing of our product. What self-locking fastener would you suggest?
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You can make high quality welds, quickly and easily, in stainless, aluminum, cast iron, HASTELLOY and MULTIMET alloys—practically all commercial metals—at lower cost with the 300 amp. HELIARC HW-10 water-cooled torch.

You'll find that the improved water-cooling system assures cooler and more effective operation even when the torch is used continuously at the full rated capacity. The cooling water flows through the power cable and torch body down to the water jacket and gas cup. The return flow follows the same route in reverse. All exterior "plumbing" has been eliminated allowing more maneuverability and preventing leakage due to accidental damage. Water-cooling makes lightweight torch construction possible, and because the power cable is also water-cooled, it too, is lightweight and easy to handle.

The HW-10 was designed so that the water passages are accessible and easily cleaned.

Electrodes are easily adjusted on the HW-10. A quarter turn of the torch cap releases the electrode for adjustment or replacement. You need no wrenches or other tools. In addition, electrode stub loss is reduced by placing the water-cooled electrode holder much closer to the arc.

Are you getting the best possible results from your present welding apparatus? Developments in the inert gas welding field have been so great and have come so rapidly that torches over four or five years old are now obsolete. Be sure that you have the highest production at the lowest cost. Modernize with the 300 amp. HELIARC welding torch.

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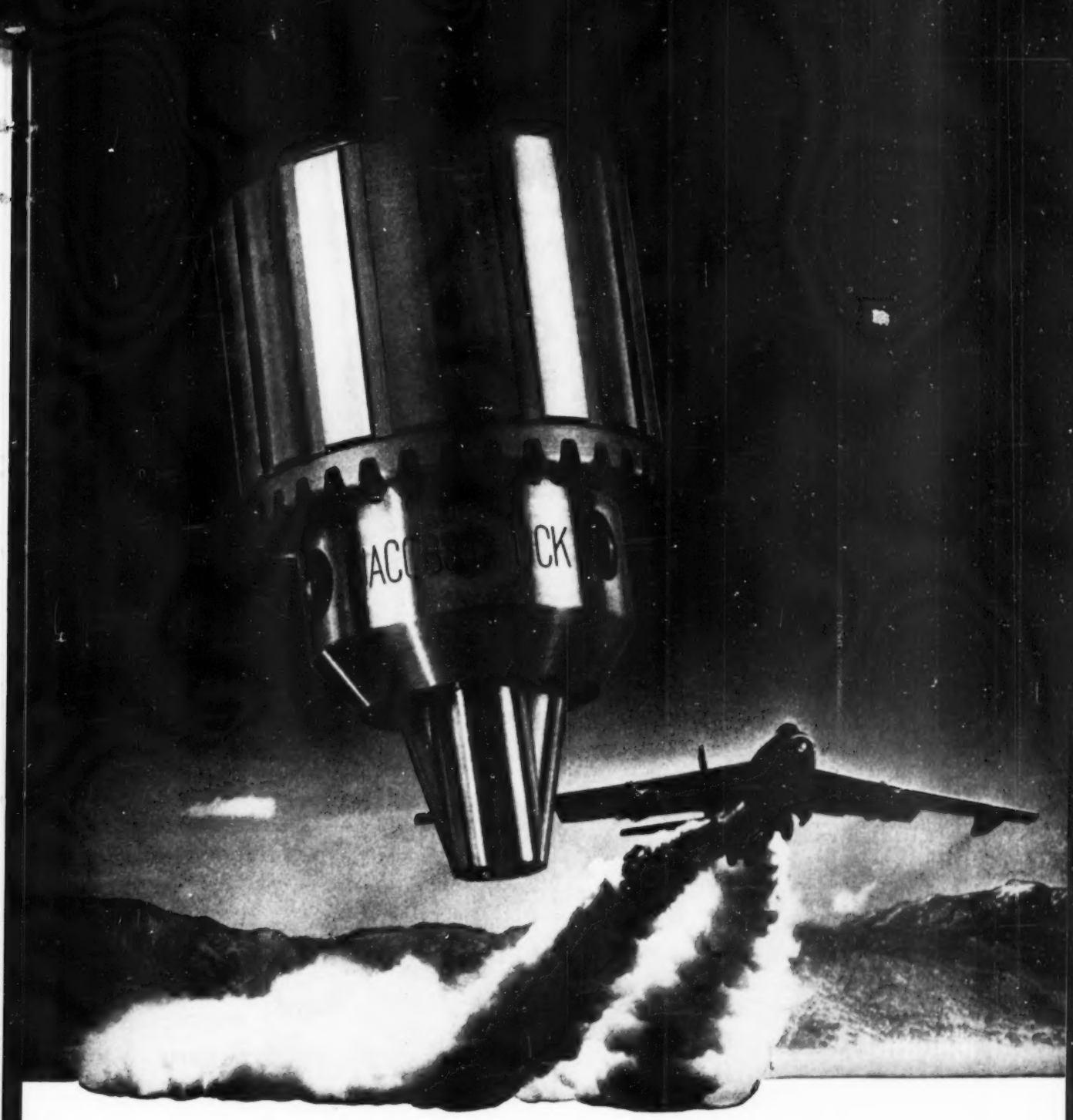

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are ready to deliver the chucks you need and the service you deserve.

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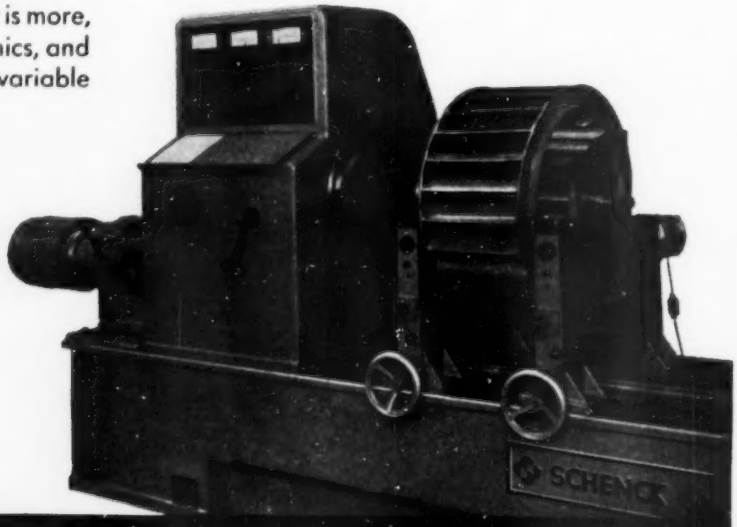
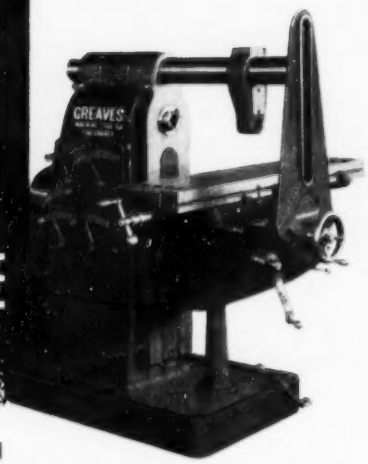
System Schenck-Federn

Let the rotor turn, and the wattmeter will show you all the necessary corrections. With this modern measuring principle outlaw oscillations do not affect the indication. What is more, Schenck machines do without electronics, and they are well suited for balancing at variable and high speeds, too.



CARL SCHENCK MASCHINENFABRIK DARMSTADT GMBH · DARMSTADT

GREAVES NO.2-H MILLING MACHINE



plain or universal

offers every modern milling machine advantage:

18 spindle speeds (20 to 1000 rpm), 18 feeds (½" to 30" per minute), rapid traverse, Timken bearings and many others.

you can't buy a better combination of simplicity, rugged construction, ease of operation, accuracy and production speed. **send for bulletin** and price list.

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And Others Engaged In Close Work

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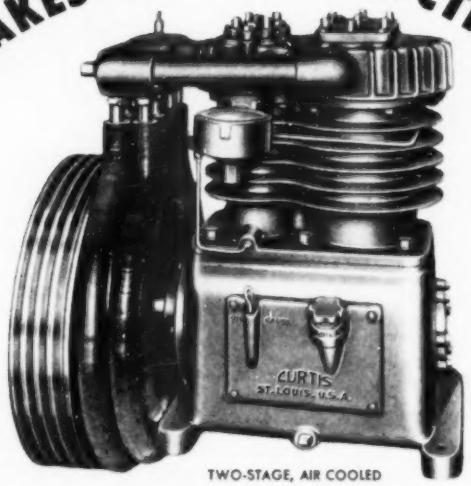
MAKES YOUR PRODUCTION MORE PROFITABLE



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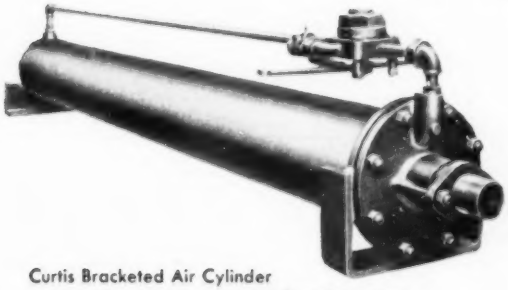

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- Cylinders are ground and polished
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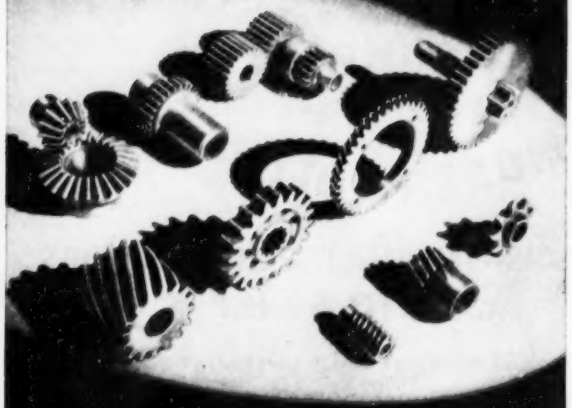

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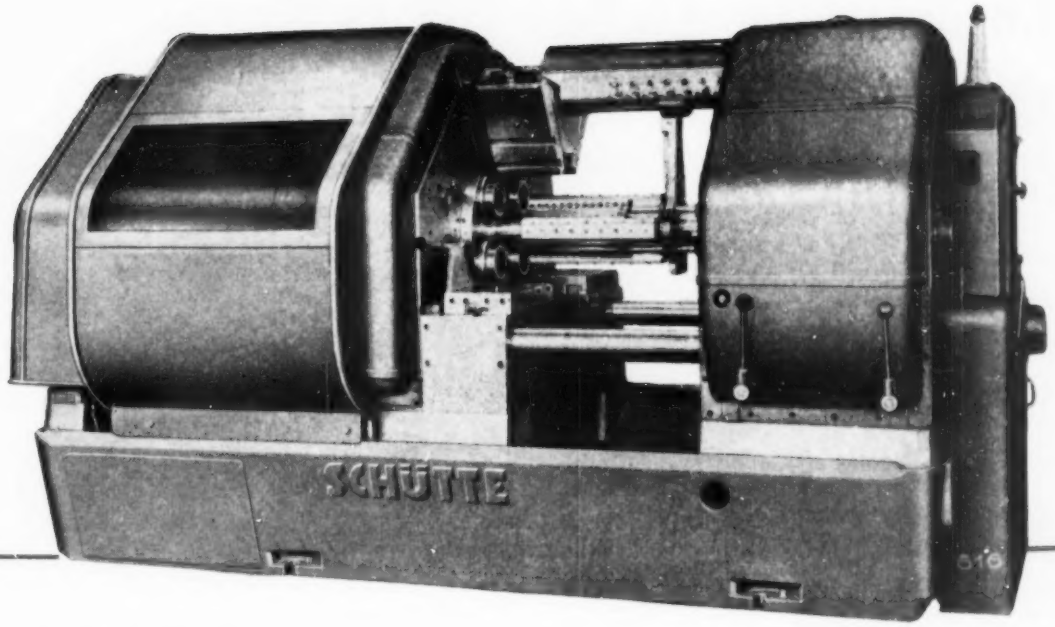

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Types VD and SD

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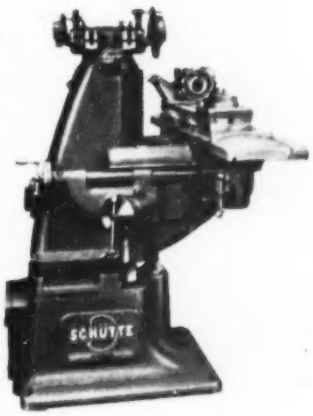

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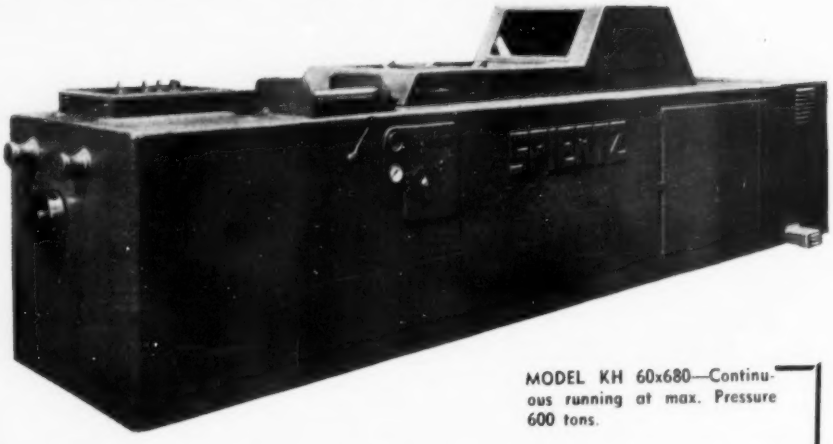

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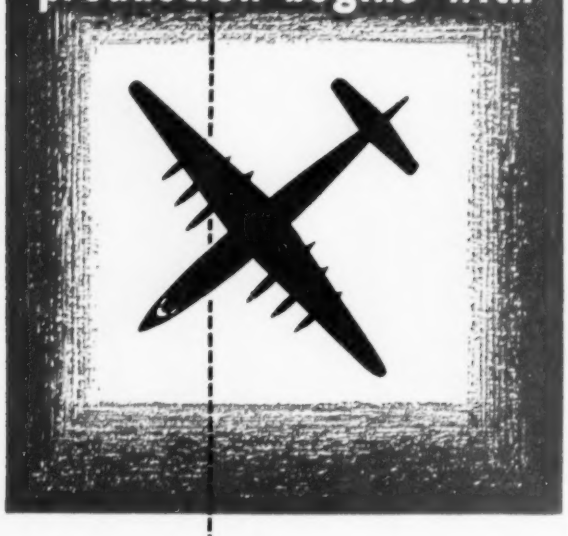
...combines the extensive experience and coordinated abilities of Republic's *Field*, *Mill* and *Laboratory* Metallurgists with the knowledge and skills of your own engineers. It has helped guide users of Alloy Steels in countless industries to the correct steel and its most efficient usage. IT CAN DO THE SAME FOR YOU.

Republic COLD DRAWN
ALLOY STEEL BARS

REPUBLIC STEEL

production begins with



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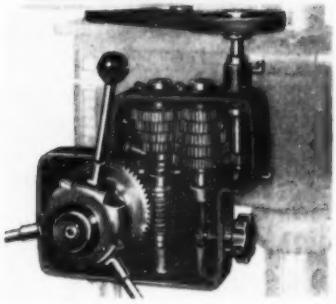

★ Drills 1" cast iron, ¾" steel ★ No. 3 Morse Taper, 6½" spindle travel ★ HEAVY-DUTY GEAR-DRIVEN POWER FEED TO TAKE FULL ADVANTAGE OF THIS BIG TOOL AND JOB CAPACITY.

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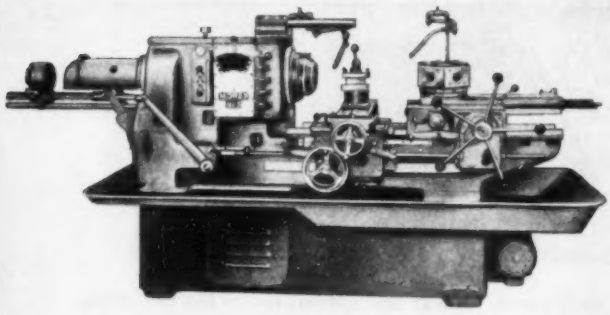

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No. 2	1" x 6"	No. 4	2" x 12"
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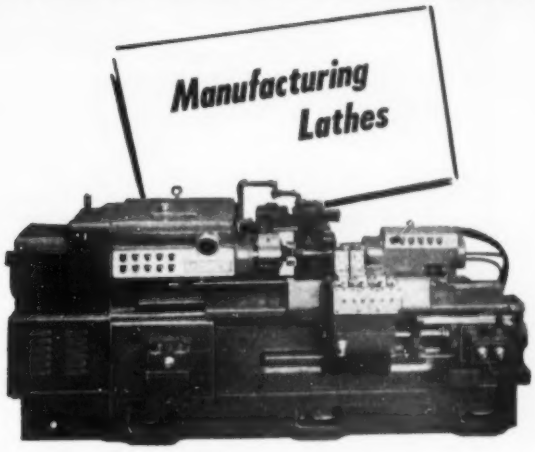
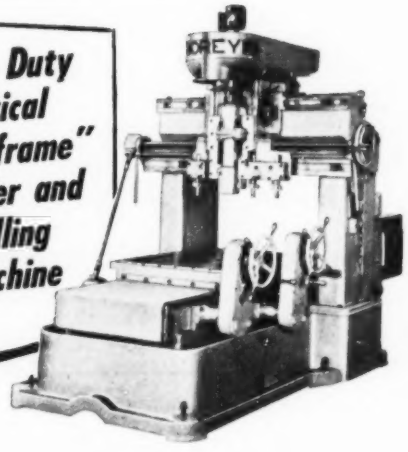
Manufacturing Lathes



Over 350 of these outstanding lathes are now in operation in the production of shells and similar parts! Finish turning is accomplished with speed and economy . . . with precision results of superior quality.

Built to take Advantage of Tungsten Carbide Tools

Heavy Duty Vertical "Aeroframe" Profiler and Milling Machine



The new 40M Milling Machine is specially designed for milling and profiling difficult and irregular shapes with ease. Inspection of the machine in operation will disclose many uses in your milling problems!

The Morey 12M Double Spindle High Speed Vertical Profiler and Milling Machine gives rapid, economical duplication of small parts that require accurate interchangeability.

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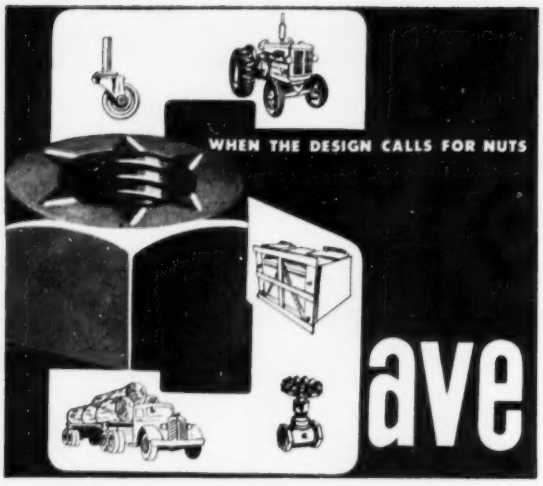
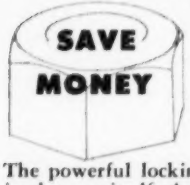


with GRIPCO LOCK NUTS

BECAUSE THEY'RE SO SIMPLE



Whatever your product is, if Economy is a factor, specify Gripco Lock Nuts. You'll save money because Gripco Lock Nuts *Cost Less.* The reason: simple design; no inserts, outside devices or gadgets that add to the cost.

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MAKE SIMILAR SAVINGS ON ALL GRIPCO NUTS

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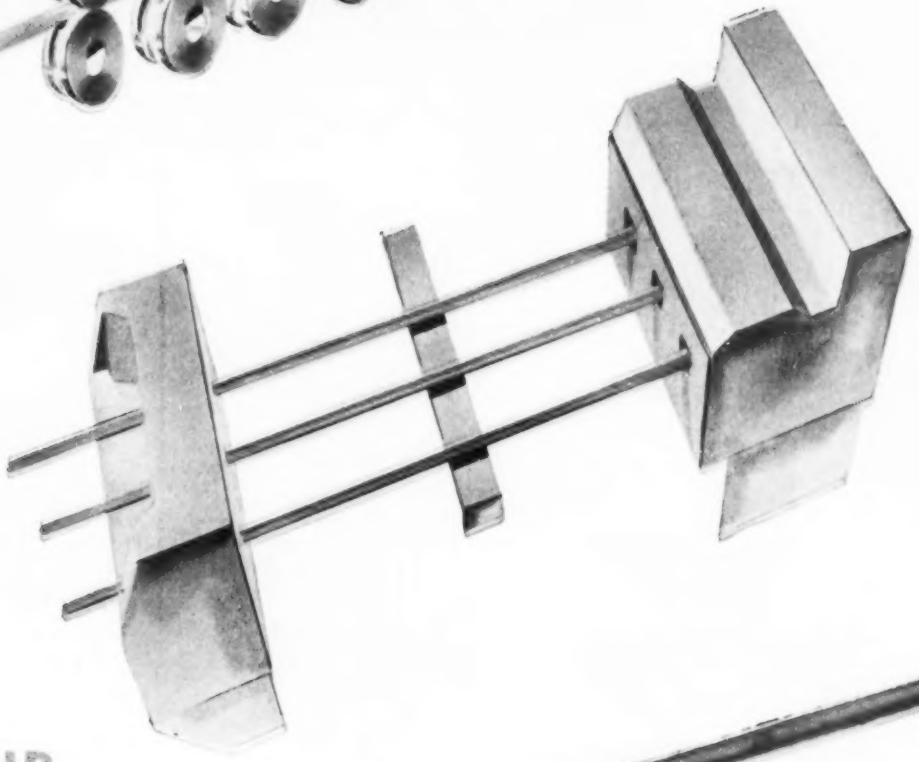

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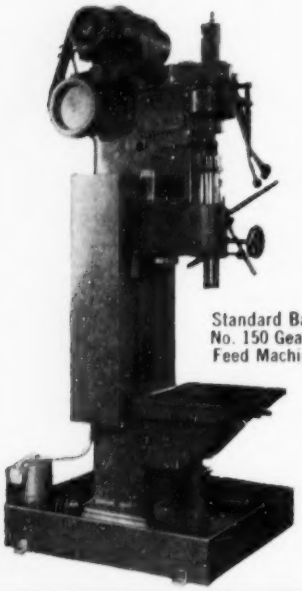
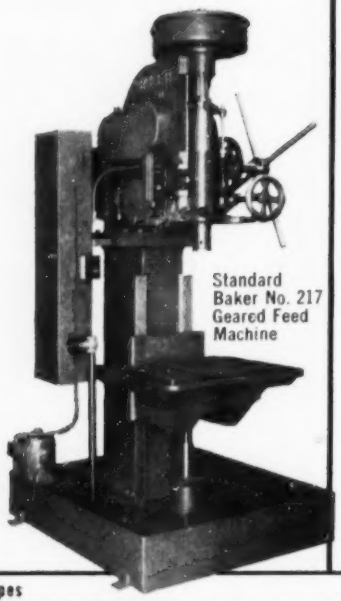
2 to 4 WEEKS DELIVERY . . .

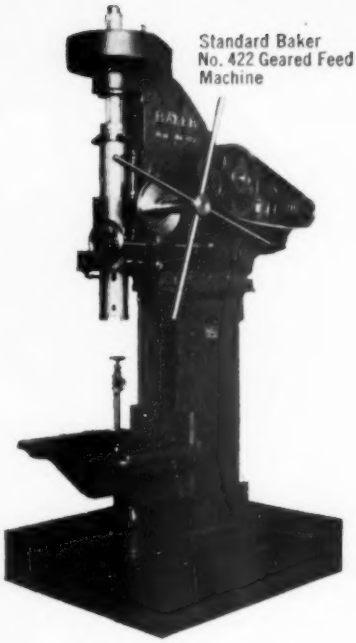
ON THESE MACHINES—Subject to prior sale



Standard Baker No. 150 Geared Feed Machine



Standard Baker No. 217 Geared Feed Machine



Standard Baker No. 422 Geared Feed Machine

Standard Baker No. 321 Geared Feed Machine

MAJOR SPECIFICATIONS—Single Purpose Types					
	150	150 Q.C.†	217	321	422
1. Capacity—Max. Dia. Drill in S.A.E. 1035 Steel	1½	1½"	2	3	4½
2. Max. H. P. Motor used	7½	7½"	10	15	20
3. Distance center of Spindle to Frame [Gap]*	11"	11"	12¼"	12¼"	12¼"
4. Maximum Spindle Travel	11"	11"	12"	16"	16"
5. Spindle—Outside Dia. splined driving end	1¾"	1¾"	2"	2-13/16"	3¼"
6. Dia. of Spindle Sleeve	2¾"	2.750"	3¼"	4¼"	5¼"
7. Dia. of Spindle Nose	2.975	2.975"	.3225	4.225"	5.225
8. Morse Taper in Spindle as standard	No. 4	No. 4	No. 5	No. 5	No. 6
9. Standard Speed Range in R.P.M.	151-632	48-1120	76-614	27-220	20-165

* Can be increased 3" by use of offset Spacer Block. † Quick Change, 12 Speeds

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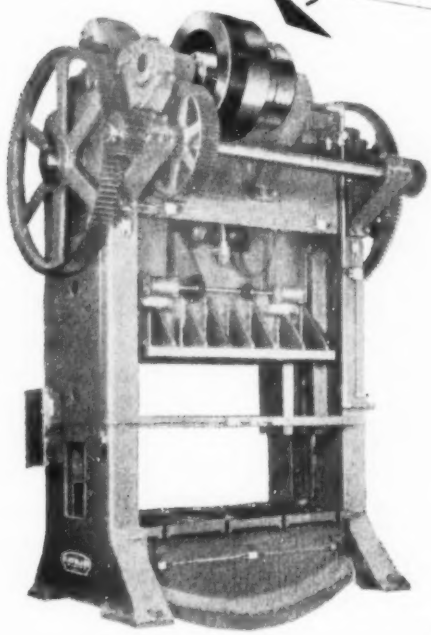

remember

the press production delays we used to have due to clutch failure? Well, this Cleveland Clutch has stopped all that. The boys say it's easy to adjust and service without removal from the press. Maintenance expenses have dropped way down.

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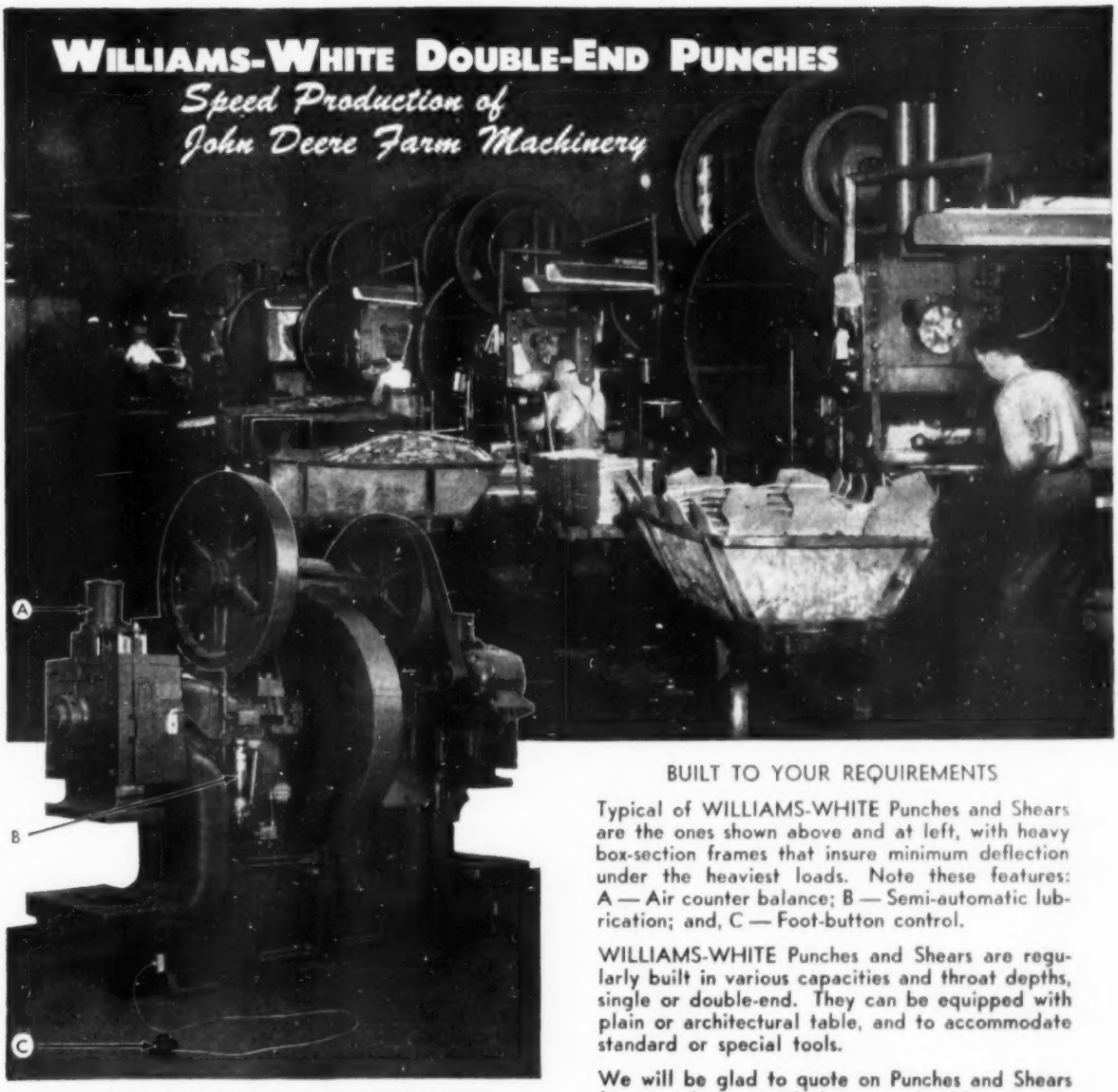

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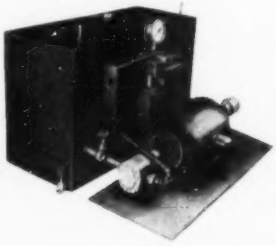

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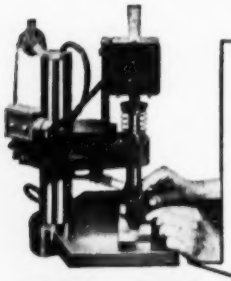

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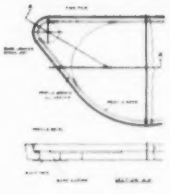

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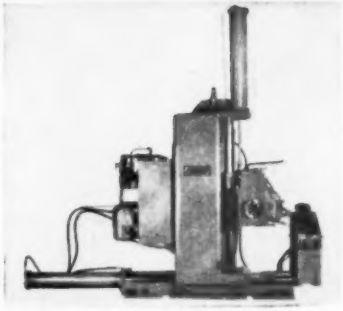

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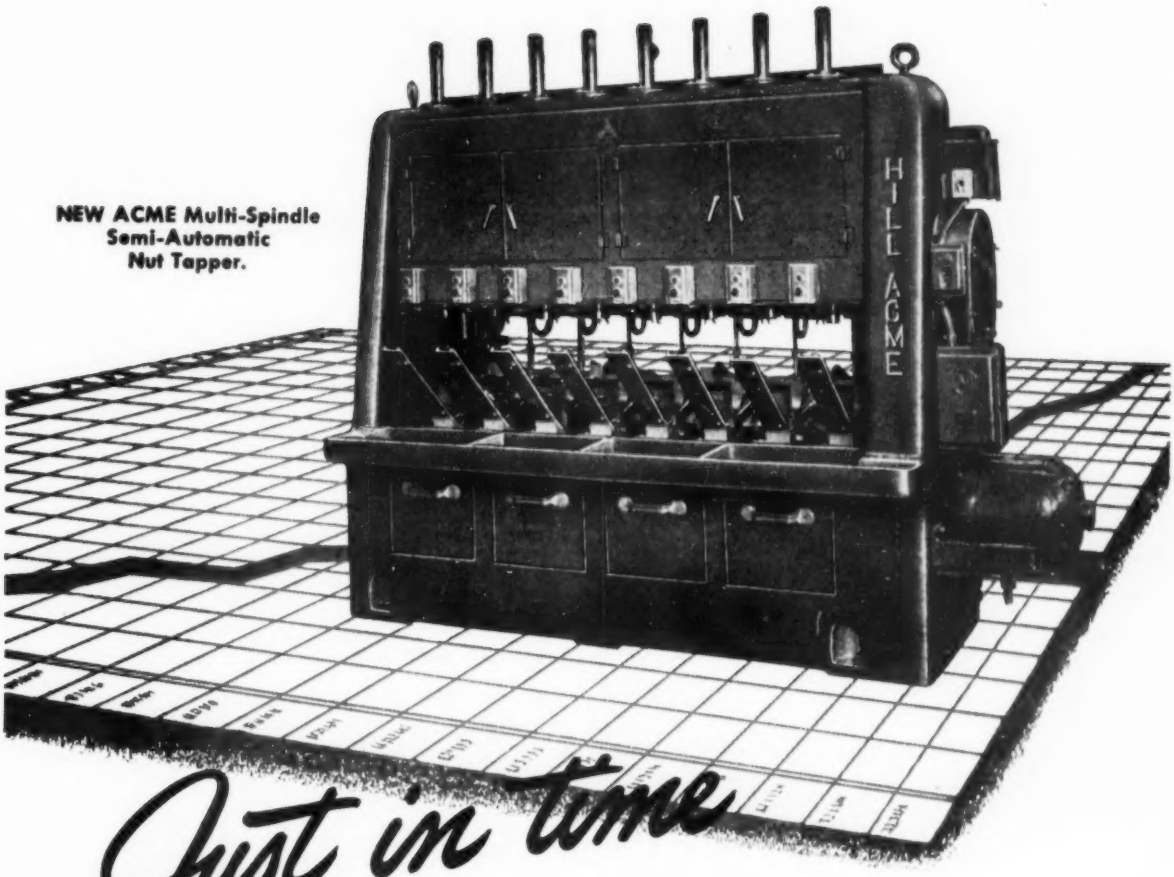

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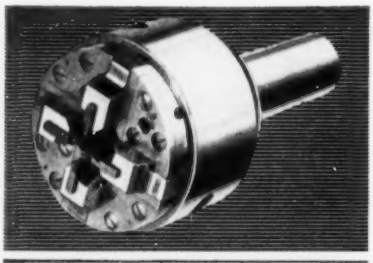

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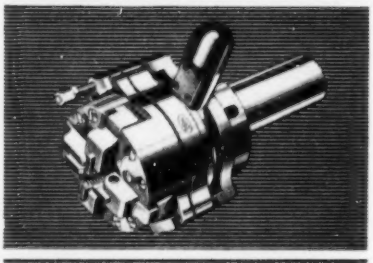

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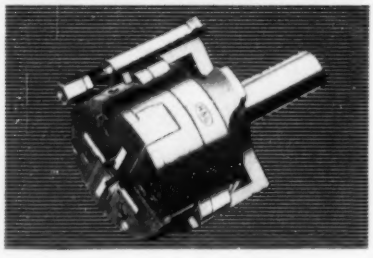

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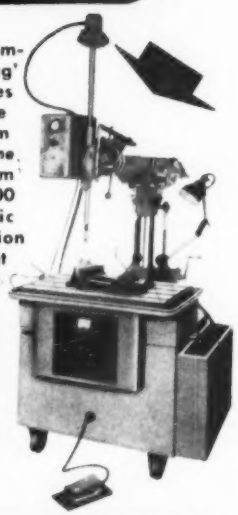

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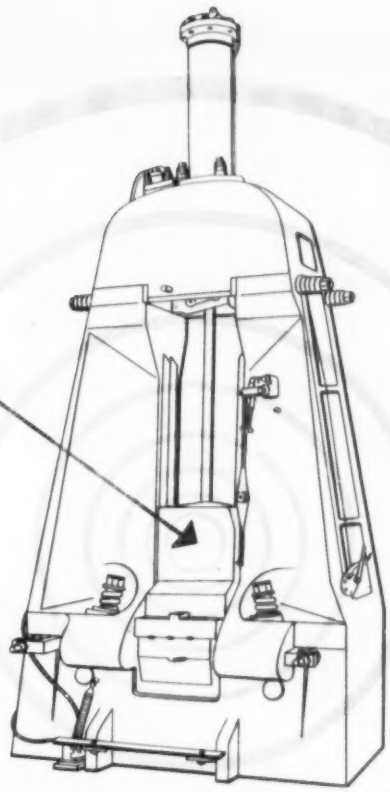

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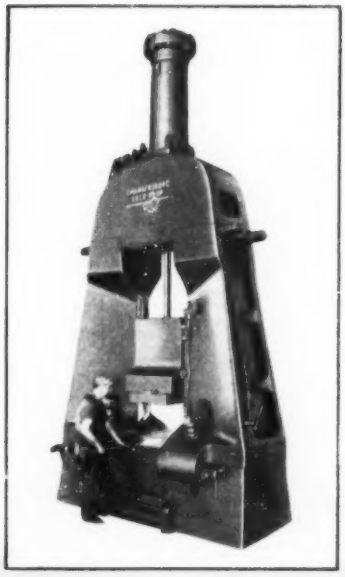

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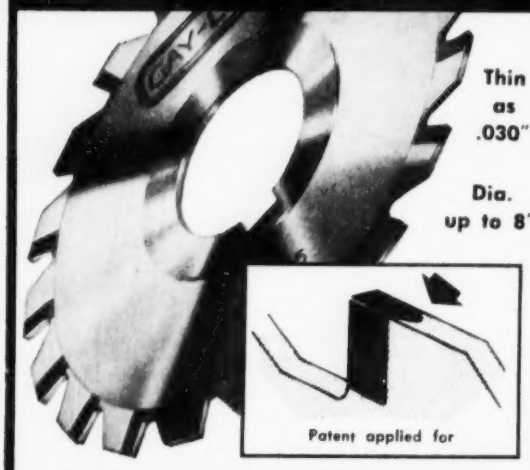

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This exclusive Gay-Lee carbide tipped saw design has completely changed the slitting, slotting and sawing picture. Now carbide tips stay in and run-out is eliminated. You get the full benefit of carbide's faster cutting ability.

WHAT IS YOUR SAW PROBLEM?

We are specialists in carbide saw design and manufacture. We have solved some tough jobs and some big ones. Can we help you?

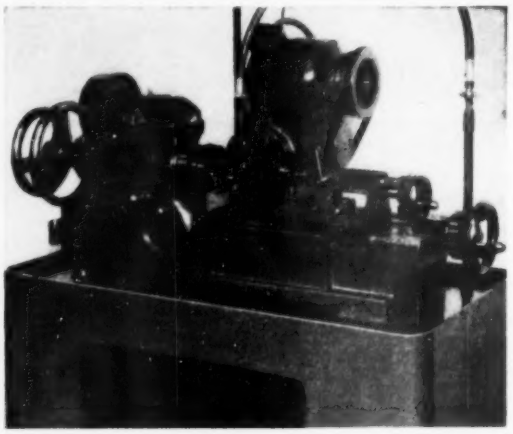
Hub Saw | Thinsaw | Small Saw

Carbide teeth profile ground on Special Order

WRITE FOR DATA

GAY-LEE COMPANY

CLAWSON • MICHIGAN



WALTHAM THREAD MILLING MACHINES

. . . for producing accurate, fine-finish threads on small diameters at low cost

This NEW model is mounted on a welded steel base in which are accessibly located control panel, coolant motor and pump. It is equipped with separate motors for cutter, work and coolant. Motor push buttons are conveniently placed.

Swing over carriage is 3" and work 2" diameter or smaller can be handled. Threads 8¾" long can be cut with work held on centers. Special attachments are available for extending the utility of this machine. *Illustrated literature available on request.*

WALTHAM MACHINE WORKS

HIGH STREET WALTHAM, MASS.

Make 3 hammers AT ONCE!

It's the NEW, easy, economical, quick way to mold your own lead hammers on a production basis with "SHUR-GRIP" handles and this COOK production mold.

COMPLETE LEAD HAMMER SERVICE

Write for circular and prices

LAWRENCE H. COOK, INC.

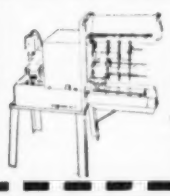
48 MASSASOIT AVENUE, EAST PROVIDENCE 14, R. I.

HERCULES HOLDERS AND TYPE

FOR STAMPING NUMBERS INTO STEEL AND OTHER METALS.

● We make the most complete line of Marking equipment in America.

WELDING ROD MARKING MACHINES



ACRO MARK Company

7-13 MORRELL ST., ELIZABETH 4, N. J.

. . . MAKES THE FINEST IN . . .

COUPLING BOLTS
MILLED STUDS
CAP SCREWS
SET SCREWS

*Wm. H. Ottemiller CO.

YORK, PENNA.

Write for name of nearest distributor and our free illustrated folder

The difference between Life... and Death...

"Why should you give blood? Ask me—I ought to know. I fought in Korea. But since then I've been through the biggest battle of all—the battle for life itself. And it was blood—and blood alone—that saved me. Don't know when I'll be in a position to start repaying my debt by giving some blood of my own. But I will—some day. You can count on it!"

All kinds of people give blood—for all kinds of reasons. But every reason for giving blood is a *special* reason . . . just as every American life that can be saved at any time and at any place . . . is special. So whatever *your* reason for giving blood, this you can be sure of: Whether it goes to a combat area, a local hospital, or for Civil Defense needs—this priceless, painless gift will some day save an American life!

Business Executives!
✓Check These Questions!

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

- ☐ Have you given your employees time off to make blood donations?
- ☐ Has your company given any recognition to donors?
- ☐ Do you have a Blood Donor Honor Roll in your company?
- ☐ Have you arranged to have a Bloodmobile make regular visits?
- ☐ Has your management endorsed the local Blood Donor Program?
- ☐ Have you informed employees of your company's plan of co-operation?
- ☐ Was this information given through Plant Bulletin or House Magazine?
- ☐ Have you conducted a Donor Pledge Campaign in your company?
- ☐ Have you set up a list of volunteers so that efficient plans can be made for scheduling donors?

Remember, as long as a *single* pint of blood may mean the difference between life and death for *any* American . . . the need for blood is *urgent!*

Give Blood Now

CALL YOUR RED CROSS TODAY!

NATIONAL BLOOD PROGRAM

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE

$1.50 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.

POSITION WANTED and Individual Selling Opportunity Wanted undisplayed rate is one-half of above, payable in advance.

PROPOSALS $1.50 a line an insertion.

INFORMATION

BOX NUMBERS count 1 line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals.).

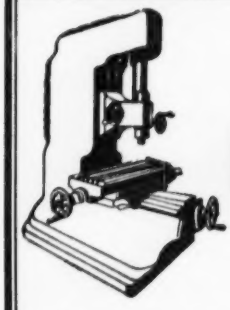
EQUIPMENT WANTED OR FOR SALE Advertisements acceptable only in Displayed Style.

DISPLAYED RATE

The advertising rate is **$12.60** per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured 7/8 inch vertically on one column, 3 columns—30 inches to a page. A. M.

NEW ADVERTISEMENTS: Address N.Y. Office, 330 W. 42 St., N.Y. 36, N.Y. for June 22nd issue closing June 8th.



SEARCHLIGHT Equipment Spotting SERVICE

This service is aimed at helping you, the reader of AMERICAN MACHINIST, locate used and surplus new metalworking machinery and equipment not currently advertised. (This service is for user-buyers only.)

Just send in the specifications of the equipment wanted on the coupon below, or on your own company letterhead, to

Searchlight Equipment Spotting Service
c/o American Machinist
330 W. 42nd St., N.Y. 36, N.Y.

Your requirements will be brought promptly to the attention of the used equipment dealers advertising in this issue. You will receive replies directly from them.

NO CHARGE • NO OBLIGATION

Searchlight Equipment Spotting Service
c/o American Machinist
330 W. 42nd St., New York 36, N. Y.

Please help us locate the following used equipment:

NAME ..... TITLE .....

COMPANY .....

STREET .....

CITY ..... ZONE ..... STATE .....

6/8/53

WANTED

CHIEF ENGINEER—Supervises plant engineering office, product design, research, tool design, and project planning. Plant engaged in large machining contract, has machine tool and die division, and stamping and welding division. This is a staff position with opportunity to grow.

CARBIDE TOOL SPECIALIST—Man with wide experience in production machining desired.

TOOL ENGINEER—Man with progressive experience in processing, designing, and try-out of tools on varied work.

CHIEF INSPECTOR—Capable of organizing and directing a department engaged in inspecting products of machine, tool, stamping, and welding plants.

PLANT SUPERINTENDENT—Must have extensive experience in directing operation of plant engaged in production machining, tooling, stamping, and welding, and must have good background in employee-management.

Positions are located in a progressive city in the Southwest with a healthy, high, dry climate. Applicants please give details of experience, references, and desired salary in first letter.

P-8032, AMERICAN MACHINST
330 W. 42nd St., New York 36, N. Y.

SUPERVISORY POSITION

WANTED: Man throughly qualified to supervise grinding equipment in machine shop including Reishauer Gear Grinders. Must be able to set up and operate all types of grinders in addition to supervise. Steady peace-time position. Write stating age, education, experience, and references. Modern northern New Jersey plant.

P7995, AMERICAN MACHINIST
330 W. 42 St., New York 36, N. Y.

TURRET LATHE FOREMAN
ENGINE LATHE FOREMAN

Opportunity with fine progressive company. Must have sound experience in lathe operations. Study work, paid vacations and other benefits. Plant location in Phila.

P-8077, AMERICAN MACHINIST
330 West 42nd Street, New York 36, N. Y.

$888 FOR YOU $888

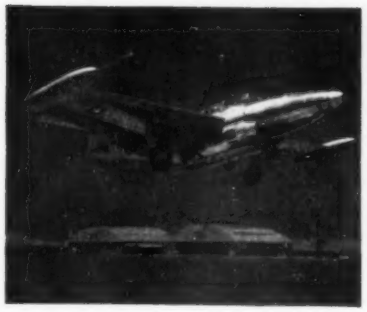
We Pay Liberal Commissions For All Leads On Contacts Pertaining To

TOOL DESIGN

Processing or special machine design. We are an established firm doing work for many nationally known Corporations.

ENGINEERING SERVICE CO.
415 No. Dearborn St., WH 3-0823, Chicago 10, Ill.

ADDITIONAL EMPLOYMENT ADVERTISING ON PAGES 361-362



Methods, process engineers . . .

LOOKING FOR A JOB THAT'LL GIVE YOU REAL SATISFACTION?

So many of us are. But the rub is that really satisfying jobs aren't so easy to find.

Here at Honeywell, though, we do have such jobs in large numbers. Like producing special gyros for the F-89 above.

And right now we have several openings for experienced engineers. Look over the specifics below. Maybe one of the jobs is what you're looking for.

Duties of the jobs. Figure ways to make quality products at minimum cost. Supervise the tooling, processing and planning necessary to transform blueprints into finished products.

Requirements. B. S. or M. S. in Mechanical, Electrical, Industrial or Chemical Engineering desirable.

Atmosphere. A company which is growing rapidly, steadily and soundly. The challenge of production is ever present.

Openings. In Minneapolis and Philadelphia.

Write J. A. Johnson, Engineering Placement Director, Dept. AM-6-129, Honeywell, Minneapolis 8, Minnesota. Learn in detail about the fascinating opportunities at Honeywell. And be sure to ask for our new book, "Emphasis on Research."

Honeywell
MINNEAPOLIS
First in Controls

LAFAYETTE GRINDING
GIANTS

Grinding Specialists at your Service

BLANCHARD
Up to 84" Diam.

PLANE SURFACE
Thomson 36" x 120"

DOUBLE DISC
All Shapes — All Materials

CENTERLESS
Infeed — Thruffed Shoulder and Bar

CYLINDRICAL EXTERNAL
Up to 16" x 80"

INTERNAL GRINDING

FLAT LAPPING
Flat Lapping — Up to 10 Inches
Surface Finishes — From 1 to 5 Rms or Less
and Flatness Accuracy to Millionths of an Inch
ALL SHAPES — ALL MATERIALS
Closest Tolerances - Fine Finishes - Perfect Flatness
Low Prices — On Time Deliveries

LAFAYETTE GRINDING CORP.
117 Banker St., Brooklyn 22, N. Y. EVergreen 8-5973

SEVERAL 20 x 96" MATTISON SURFACE GRINDERS
Available for Job Work

On grinding of steel flat shapes. Particularly interested in large runs where customer furnishes raw or partially finished material, where grinding only, is required.

CW-7078, AMERICAN MACHINIST
330 W. 42 St., New York 36, N. Y.

BEVELED GEARS

Manufacturer has some available time for straight cut beveled gear work running from 1½" to 20", depending upon ratio, 4 pitch to 24 pitch. Equipped to handle coniflex or straight bevel tooth if required.

SIER-BATH GEAR & PUMP CO., INC.
9252 HUDSON BOULEVARD
NORTH BERGEN, NEW JERSEY

10 to 12 ft. Lengths
ALL METALS
Also special screw machine products to order
EASTERN
MACHINE SCREW
20-40 Barclay St.
New Haven, Conn.
Makers of
H & G DIE HEADS

PATTERNS in WOOD and METAL
For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us — we will take care of them
GENERAL PATTERN WORKS
2233 Rush Street Cincinnati, Ohio

OPEN TIME

Turret Lathes (Bar and Chucking up to 2", Automatic Screw Machine—2¼" Capacity, Millers, Lathes up to 30"x10', Drill Presses, Welding, Plating, Heat Treating and Assembly. Can do parts or complete assemblies.

FRANKLIN MACHINE PRODUCTS CO., INC.
West Trenton, New Jersey

If immediate EXPANSION is your PROBLEM . . . LET

MacDELL take over—especially where DELIVERY and ECONOMY are important factors. Every one of our machines is unconditionally guaranteed and practically any machine can be inspected—under power (before purchase)—right in our showroom. We have the machines for your need—priced right—in good working condition—available immediately. You can't miss if you make MacDELL your headquarters for used equipment.

BALANCERS
GISHOLT 3S Dymetric Balancer, 1943
GISHOLT 12E Static, 1948.

BENDING ROLLS
SOUTHWARK 20'x1" Pyramid Type, Drop End, Balance Bar.

BORING MACHINE
HEALD #49 Double End Bore-Matic, 1942

DRILLS
Avey 6-Spindle No. 2MA6 Power Feed, No. 2 MT, 12" Overhang, 1943.

FOR EXAMPLE . . .

TYPE "D"

MULT-AU-MATIC

We have a BULLARD 12" 8 Spindle Type "D" Mult-Au-Matic, 1941, Power Chucking, available for immediate delivery. This late type machine is well tooled.

It will be offered to you at a substantial savings — compared with replacement cost. We'll be happy to send complete specifications and complete list of tooling.

BARNES No. 201 Single Spindle, Lead Screw Tapping, Power Feed, 1941.
ALLEN No. 2 MS Single Spindle, No. 2 MT, Power Feed, 12" Overhang.

GEAR EQUIPMENT
BARBER-COLEMAN Model A Gear Hobber, 1943.
FELLOWS 61A Gear Shaper, 1941.
PRATT & WHITNEY 10" Hydraulic, 2 Wheel Gear Grinders (2), 1941.

GRINDERS, CYLINDRICAL
CINCINNATI 10"x36" Model ER, Plain Hyd. Equipd. for Plunge Grinding, 1942.
LANDIS 10"x24" Universal Hyd. with Internal Spindle 1942.
NORTON 10"x18" Type C Hydraulic, 1942.
BROWN & SHARPE No. 5 3"x18" Plain with Plunge Grinding, 1943.
BROWN & SHARPE No. 5 3"x12" Plain with Plunge Grinding, 1941.

GRINDERS, MISC.
NORTON 6"x18" Hydraulic Surface, 2 available, 1942 and 1943.
HEALD No. 25A 16" Rotary Surface, 1942.
HEALD No. 22 Rotary Surface, 12" Chuck, 1941.

LATHES, AUTOMATIC & PRODUCTION
POTTER & JOHNSON 5D Automatic Chucker with Air Chucking Equipment, 2 available, 1942.
SUNDSTRAND 12A Automatic Lathe, Air Equipment, 1951.
LODGE & SHIPLEY 3A Duomatic, 1946.
SENECA FALLS Model R-14 Lo-Swing, 1942.
SENECA FALLS Model LR Lo-Swing, complete, 1942.
LeBLOND 13" Rapid Production Lathe, 1200 RPM, 1945.

LATHES, TURRET
GISHOLT 1L Saddle Type Bar and Chuck, 1944.
GISHOLT No. 4 Ram type Universal. Bar feed, 1944.
GISHOLT No. 3 Ram type Universal, Bar & Chuck, 1943.

MILLS
CINCINNATI 56-90 Plain Hydromatic.
KEARNEY & TRECKER 2K Vertical, 1943.
KEARNEY & TRECKER 2HL Plain, 1943.
KEARNEY & TRECKER Model 1H—18" Manufacturing Mill, 1941.
U. S. MULTI-MILLER MM-1-5-2 Rise and Fall, 1943.
U. S. MULTI-MILLER MM-1-60, 1944.

MULT-AU-MATICS
BULLARD 12" 8-Spindle, Type D, with Power Chuck and Tooling, 1941.

. . . TELEPHONE MOnroe 6-7715 . . .

MacDell CORPORATION
1042 W. LAKE ST. • CHICAGO 7, ILL.

REPLIES (Box No.):
Address to office nearest you
NEW YORK: 330 W. 42 St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

EMPLOYMENT SERVICE

SALARIED POSITIONS $3,500 to $35,000. We offer the original personal employment service (established 43 years). Procedure of highest ethical standard is individualized to your personal requirements. Identity covered; present position protected. Ask for particulars. R. W. Bixby, Inc., 266 Dun Bldg., Buffalo 2, N. Y.

SELLING OPPORTUNITY WANTED

WANTED TO represent a manufacturer of proven time and cost saving machine-shop tools and equipment for California. On agents or dealership basis. RA-7916, American Machinist.

BUSINESS OPPORTUNITY

Inventor—with an improved design of drafting machine for the medium price market wishes to contact manufacturer with distribution facilities—royalty basis. BO-8050, American Machinist.

AVAILABLE
2 SALES ENGINEER

Now selling Met. N. Y. and N. J. tool room machinery, cutting and screw machine tools, gages, desires an additional quality line. Excellent national and medium sized machine shop contacts.

RA-8038, AMERICAN MACHINIST
330 W. 42 St., New York 36, N. Y.

OPEN CAPACITY
DEEP HOLE DRILLING & REAMING

To close tolerances in all metals including alloy & stainless steel, aluminum, etc. Capacity .180 to ⅞" holes x 80". Also adequate capacity for related secondary operations of grinding, turning, threading, plating etc.

JOHNSON AUTOMATICS Arms Co., Inc.
PO Box 1512, Providence 1, R.I.

WANTED

LARGE LATHE WORK
up to 80" Dia.

EISLER ENGINEERING CO., INC.
738 So. 13th St., Newark 3, N. J.

WORN DIAMONDO TOOLS RESET
$1.00 EA., SAME DAY SERVICE

Mfgr's. Of A Complete Line Of Grinding Wheel Dressers

DI-TRU DIAMOND TOOL CO.
1479A 38 St., Bklyn. 18, N.Y.
UL 3-3426

ELECTRIC FURNACE TO 1850°

with Auto Temperature Control. Sliding door. Cheap to operate. Substantial Dependable for Machine Shop, Tool Room.

8" x 12" x 15" inside 4.5 K.W. $250.00
12" x 16" x 20" inside 9.0 K.W. $450.00

E. H. WILLIAMS
BOX 9042A, HUNTINGTON, W. VA.

WANTED

WANTED . . . TO TRADE
Your Idle Machinery
For
Our Active Dollars

Send Us Your List
We Buy and Sell
Standard and Specail Machinery & Equipment

SAMSON MACHINERY CO.
643 W. ROOSEVELT ROAD
CHICAGO, ILL.
TAy 9-5795

MACHINERY WANTED
Highest prices paid for late type machine tools.
Write — wire — phone
J&L MACHINERY & SUPPLY CO.
7906 Mack, Detroit, Mich

BUY FROM STOCK
Telephone
BAKER 5887

FALK
MACHINERY COMPANY

10 WARD ST.
ROCHESTER 5
N. Y.

Every Item Guaranteed as Represented

AUTOMATIC #0 B & S Wire Feed Screw, Late.
AUTOMATIC, Cleveland Model #B-1½" Sgl. Spdl.
AUTOMATIC #2 B & S Wire Feed, 1" screw, Late.

BALANCER, Anderson Bros. 14"x64", Rots-Checker.
BORING MILL, 24" Bullard M.D., V.T.L.
BORING MILL, 36" Bullard M.D., V.T.L.
BORING MILL, 36"x44" Niles Vert. M.D., Side Head.
BORING MILL, 2¼" Lucas Horiz., M.D.
BORING MILL, Lucas Horiz. 3" Bar, M.D.
BORING MILL, Giddings & L #6 Horiz. 3½" Bar.
BARRELS, Tumbling Lupomatic, Schutte & Koerting.
BRAKE, #335 Chicago, M.D., Press, 6' 15 ga., NEW.
BRAKE, #185 Chicago Power Apron, 8'x3/16" cap.

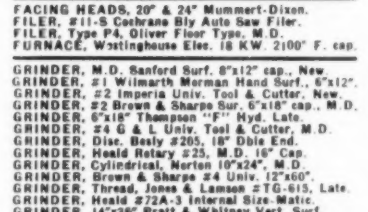
COMPRESSOR, Ingersoll Rand ER-1, 10 HP, M.D.
COMP., 15 HP, 10 HP, Gardner Denver, M.D., New.
COMPRESSOR, C-P 50 HP, M.D., 10x10, 278 CFM.
COMPRESSOR, Ing.-Rand ER-1, 100 HP Syn. M.D.
CRANE, GET Ricker 2 tons 11'9" span.
CRANE, Canton #8 Portable Gooseneck 3 ton cap.
CHIP WRINGER, 20" Tolhurst M.D., Late.
GAS CUTTER, Airco #4 & #10 DB Radiagraph.

RADIAL DRILL, 3' 9" Mueller, M.D.
RADIAL DRILL, 4'x11" American, M.D.
RADIAL DRILL, 5'13" Cincinnati-Bickford, M.D.
RADIAL DRILL, 6'x15" Cincinnati-Bickford, M.D.
RADIAL DRILL, 30" Walker Turner M.D., Late.
DRILL, Fosdick 16", S.S. Power Feed, M.D.
DRILL, #2 Colburn H.D. #4 M.T., M.D.
DRILL, #121 Baker Auto. S.S. Cam Operated.
DRILL, Deep Hole, Avey-Draulic #2, M.D.
DRILL, Edlund #2B, 3 spdle. #2 M.T., 16".
DRILL, 4 & 6 Sp. Avey 12" overhang, #3 M.T., M.D.
DRILL, 4 Sp. Barnes H.D., M.D. #4 M.T., P.F.
DRILL, Cincinnati 21" with Tapping Attach. M.D.
DRILL, Natco Multiple Spdle. #12, #1 M.T., M.D.
DRILL PRESSES, Leland Gifford #1MS, 1, 2, 3, 4.
DRILL PRESS, #2MS Buffalo Forge single spindle.
DRILL, Barnes, 24" S.S. #4 M.T., 1¾" cap.
DRILL PRESS, #25 Foote-Burt S.S. 24", #5 M.T.
DRILLS, #14, #15, #16, #18 Buffalo Forge, M.D.
DEEPFREEZE Motor Products 40 below zero.
DEMAGNETIZER, SB-911 Magnaflux, late type.

FACING HEADS, 20" & 24" Mummert-Dixon.
FILER, #11-S Cochrane Bly Auto Saw Filer.
FILER, Type P4, Oliver Floor Type, M.D.
FURNACE, Westinghouse Elec. 18 KW. 2100° F. cap.

GRINDER, M.D. Sanford Surf. 8"x12" cap., New.
GRINDER, #1 Wilmarth Morman Hand Surf., 6"x12".
GRINDER, #2 Imperia Univ. Tool & Cutter, New.
GRINDER, #2 Brown & Sharpe Sur. 6"x18" cap., M.D.
GRINDER, 6"x18" Thompson "F" Hyd. Late.
GRINDER, #4 G & L Univ. Tool & Cutter, M.D.
GRINDER, Disc. Besly #265, 18" Dble End.
GRINDER, Heald Rotary #25, M.D. 16" Cap.
GRINDER, Cylindrical, Norton 10"x24", M.D.
GRINDER, Brown & Sharpe #4 Univ. 12"x60".
GRINDER, Thread, Jones & Lamson #TG-615, Late.
GRINDER, Heald #72A-3 Internal Size-Matic.
GRINDER, 14"x36" Pratt & Whitney Vert. Surf.
GRINDER, Pratt & Whitney 22"x84" Vert. Surface.
GRINDER, Greenfield #12 Int. Hydromatic, M.D.
GRINDER, Oliver Auto. M.D. Drillpointer, #510.
GRINDER, #33 Abrasive Vert. Auto. Surface, M.D.
GRINDER, #22 Heald Horiz. Rotary Surface, N.D.
GRINDER, Diamond Snagging 10 HP, 24"x4¼".
GRINDER, Norton 6x18 Vert. Surface, Hyd. Late.
GRINDER, #60 & #70 Heald Internal.
GRINDER, Landis 6"x18" Hyd. Cyl. late type, M.D.
GRINDER, Sellers Type #1A Tool, 24" wheel.
GRINDER, 37" Wheel Dia. Osterholm Disc, 24" cap.
GRINDER, 36" Ingersoll Tub Face Mill, M.D.
GRINDER #79-72" Gardner Vert. Spindle, Late.
GRINDER, #214—30" Besly Double End Disc, Late.
PROFILE GRINDER, Studer Type PSM, M.D., late.
GEAR LAPPER, #8LS, #13LS Fellows, Outboard Supports.
GEAR SHAPER, Fellows #6 High Speed, M.D.
GEAR SHAPER, Fellows #7 High Speed, M.D.

HAMMER, Rochester Hispeed, all sizes, M.D.
HAMMER, Bradley 200# Rubber Cushioned Helve.
HEADER, Manville #1 S.S.D.D. Cold 3/16".
INDUCTION HEATER, 16 KVA Ecco Hi Frequency.

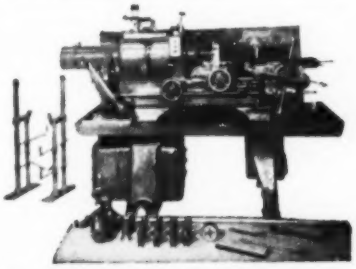


4DE POTTER & JOHNSTON Automatic Turret Lathe, Motor Driven T.E.F.C. 7½ HP. 3/60.220/440.

INDUCTION HEATER, 30 KW Lepel, Late Type.
AIR MOTOR HOIST, Ingersoll Rand 2000# cap.
ELECTRIC HOISTS, 500-4000 lbs. Whiting. NEW.
HONE, #194 Barnes Vertical, M.D., Hyd. Late.

KEYSEATER, #5 Mitts & Merrill, Giant, M.D.
LAPPER, 2F Norton Vert., M.D., late type.

No. 7 BARDONS & OLIVER Geared Head
Full Universal Turret Lathe, Preselector Head, Bar Feed, 4" capacity through spindle, Late Type, Motor Driven.

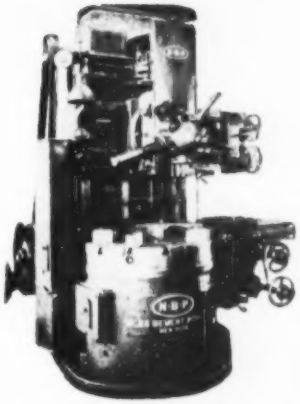


#2 WARNER & SWASEY Geared Head Turret Lathe, 12 Spindle Speeds, Bar Feed.

LATHE, Le-Swing 8"x100", M.D., A.C. Rebuilt.
LATHE, Porter-Cable 9"x15" Geared Head Prod.
LATHE, 12" Reid Smallpiece Production, Late Type.
LATHE, Hendey 12"x5' Q.C.G. Taper Attach. M.D.
LATHE, LeBlond 14"x6', Q.C.G., M.D.
LATHE, Hendey 14"x8' Q.C.G. Taper Attach. M.D.
LATHE, American 16"x6' Q.C.G., Grd. Hd. M.D.
LATHE, Lehman 18"x7' Q.C.G., M.D.
LATHE, American 18"x10' Q.C.G., Grd. Hd.
LATHE, South Bend 18/28"x8' Gap Bed, Q.C.G. M.D.
LATHE, Reed-Prentice 20"x10' Grd. Hd. M.D.
LATHE, LeBlond 22"x18' Q.C.G., M.D.
LATHE, 24"x12' Boye & Emmes Grd. Hd., T.A., Late.
LATHE, Putnam 23/32"x12' Q.C.G., M.D.
LATHE, LeBlond 24"x14' Q.C.G., Grd. Hd.
LATHE, Lodge & Shipley 26"x14', Q.C.G., M.D.
LATHE, Bridgeford 27"x12' Geared Head, M.D.
LATHE, 27"x16' Niles Timesaver, Grd. Hd., M.D.
LATHE, Bridgeford 32"x16' Q.C.G., Grd. Hd.
LATHE, 42"x18' Pittsburgh Geared Head, M.D.
LATHE, Bullng Dble. End #VMT5, Devine Bros.
LATHE, Turret #1 Bardons & Oliver Electric Head.
LATHE, Turret, #2 Simmons Vari Drive 220 V.
LATHE, Turret #2 W & S Univ. Grd. Hd., Late.
LATHE, Turret, #4 Warner & Swasey Univ. 1½".
LATHE, Turret #4DE Potter & Johnston Auto., 1942.
LATHE, Turret #6 Warner & Swasey Grd. Hd. Ram Type, Bar Feed, Motor in base.
LATHE, Turret #7 Bardons & Oliver, 4" cap., Late.
LATHE, Turret #2 Cinci. Acme Univ. Geared Head.
LATHE, Turret, #3A Warner & Swasey Univ. M.D.
LIFT TRUCKS, Baker 1 & 2 ton, Platform & Fork.

MILL, #4 Burke Motor Driven, Late, M.D.
MILL, #2 Pratt & Whitney Prod. Duplex, M.D.
MILL, #3VB Hardinge Vert. Bench, M.D.
MILL, #4B Brown & Sharpe H.D., Horiz. M.D.
MILL, #14 Garvin Plain Horiz., M.D.
MILL, #0Y Brown & Sharpe Plain Horiz., M.D.
MILLING MACHINE, #2B K & T Horiz., M.D.
MILL, Cinci. Horiz. #3, #4, #5 High Power, M.D.
MILL, #1 Brown & Sharpe Plain Horiz., M.D.
MILL, #0-8 Cinci. Vert. Prod. Late, M.D.
MULT-MILLER, U.S. Tool #MM-1-6 Auto. Prod.
MILL, #0 Douglas Plain Horiz. M.D., Coolant.
MILL, #0 Sundstrand Rigidmil Hyd. Late Type.
MILL, #0 Vernon Hand Mill, M.D., Late.
MILL, 2A Brown & Sharpe Horiz. Univ., M.D.
MILL, #2SP Van Norman Horiz. M.D., Late.
MILLING MACHINE, Kempsmith #2 Horiz. Univ.
MILL, #3 Cinc. Univ. Horiz., M.D.
MILLING MACHINE, LeBlond #4 Horiz. Univ.
MILL, #2 Vert. M.D. Brown & Sharpe.
MILL, #3 Cinci. Vertical Hi Power, M.D.
MILL, #5C Becker Vert. Die Sinker, M.D.
MILL, 42"x36"x12' Ingersoll Planer Type, 4 hds.
MILLING MACHINE, #2 Van Norman Duplex, M.D.
MOTOR GENERATOR SET, Gen. Electric, 100 K.W.
NIBBLER, #136 Savage 36"x3/16" Cap., M.D.
NAILING MACHINE, No. 16—48"-54" Morgan, Late.

THREADING, Staybolt Lassiter Millholland 1½".
THREAD MILL, 7½x11 Hanson-Whitney, Univ.
THREAD MILL, 6x14 Pratt & Whitney No. 1105.
THREAD MILLER, Lees-Bradner #40A Automatic.
THREAD MILLER, Plan-O-Mill #3 Planetary Form & Thread Semi-Automatic Milling Machine, Late.



36" x 44" Niles Vertical Boring Mill, Side Head, Motor Driven.

#40A Lees-Bradner Automatic Chucking Thread Mill, Motor Driven, Late Type.

PAPER SHREDDER, No. 10 Mitts & Merrill, M.D.
PLANER, Cincinnati 30"x30"x12' A.C., M.D.
POWER PRESS, Bliss #164 Open Back, M.D.
POWER PRESS, Bliss #3A S.S. Dble. Crank Gap 45 tons, 4" stroke, 36"x26" Bed Area, M.D.
POWER PRESS—Bliss-Consolidated #163-B Straight Side Dble. Crank 45 tons, M.D.
PRESS, #5 Johnson OBI, 56 tons, new.
PRESS, #7 & #8 Johnson OBI 70 & 90 tons, New.
PRESS, 135 Ton Clearing Single Crank 8" Str., Late.
PRESS, 70H Drake Hyd. Arbor, New.
PRESS, Federal #2 O.B.I. Grd. 2" Stro.
PRESS, Bliss #18, #19, #20, #21, OBI, A.C., M.D.
PRESS, Waterbury-Farrel High Speed 60 tons #3W
PRESS, 60 C Bliss Double Action, 3 crank.
PRESS, Lucas 15 tons Power Arbor, M.D.
PRESS, #68 Whitney Deep Thr. 24", foot.
PRESS, P2, P3 Ferracute M.D. Roll feed.
WHEEL PRESS, 600 ton Niles Bement Pond, A.C.
PANTOGRAPH, #1A Gorton M.D. Engraving.
PUNCH, #46 Buffalo Forge Vert. Cap. 1"x1¾" M.D
PUNCH, R-4 Wiedemann Turret, 10 Stat. 24" thr.
PUNCH, Hecker Turret, 8 station, cap. 2½" hole.
PUNCH, H & J #2 Sgle. End. 24" Thr. 1" thru 1".
PUNCH, H & J #4, 48" thr., with Shear Blades.

RIVET SETTER, ¾" cap. Penn. Tubular Rivet.
ROLLS, Bertsch Pyramid 18'x1¼" cap., M.D., Late.
ROLLS, #1 Buffalo Forge Wrapping, M.D.
ROLLS, 72"x¼" Lown Initial M.D., New.
ROLLS, #2 Buffalo Forge Vert. Angle, Bending, New.

COLD SAW, Wagner 10"x10" cap., M.D.
COLD SAW, Espen-Lucas #700, 48" dia. blade, M.D.
CUT-OFF SAW, Yates-American #M-90, M.D.
SAW, #48 Marvel Hack Saw 6"x6" Cap., M.D.
SAW, #20-C Racine Shear Cut 6"x6" cap., M.D.
SAW, Band Tannewitz GH-36" High Speed, M.D.
SHAPER, 16" Pratt & Whitney Crank, M.D.
SHAPER, 20" Rockford Univ. M.D., Tilting Table.
SHAPER, G & E 24", high duty, back geared, M.D.
SHAPER, 32" Cinci., B.G., Motor Driven, H.D.
SHAPER, Morton, 36" Draw-Cut, 4 speed M.D.
SHEAR, #26 Buffalo Forge Slitting Armor Plate.
SHEAR, Quickwork #11 Rotary 60" Throat, 10 ga.
SHEAR, 10' x 10 ga. Wysong & Miles, M.D., New.
SCREW SLOTTER, #2 Waterbury Farrel Auto.
SLOTTER, 12" New Haven Vertical, M.D.
SPRU CUTTER, Milwaukee 56 tons, 2½ cap., M.D.
SURFACE PLATES & TABLES, all sizes.
TAPER, #1 Cam Hankins, Motor Driven, Late.
TAPER, #1 Bakewell (Warner & Swasey) Late.
TRUCK, 2000 lbs. Hyster Fork Lift 9' Model QT-20.
TRUCK, 4000 lbs. LT-44 Towmotor Fork, Lift 9'.
BRINELL TESTER MACHINE, Type UK300M.
BRINELL TESTER, Type 03DR, Steel City.
WELDER, 500 amp. Westinghouse Flexers A.C.
WELDER, 200 & 400 amps. Gen. Elec. Portable Arc.
WELDER, 75 KVA Federal M.D., Spot.
WELDER, 200 KVA Federal, Projection.
WIRE STITCHER, Morrison and Acme, M.D.

OVER 2000 MACHINE TOOLS AVAILABLE IN STOCK

HEADLINERS

TURRET LATHES

No. 1-A Warner & Swasey, Timken, covered ways

No. 2 Acme Full Universal, Timken, hard ways

No. 5 Gisholt Universal, hard ways, new 1943

No. 601-DD Oster "Rapiduction"

VERT. TURRET LATHES & BORING MILLS

24" Bullard "New Era", side head

36/44" Niles-Bement-Pond, side head

42" King, two heads, p.r.t.

LATHES

14"x30" Lodge & Shipley Selec. Grd. Hd.

20"x72" ctrs Lodge & Shipley Selec. Grd. Hd., a.c. m.d.

22"x74" ctrs Lodge & Shipley Selec. Grd. Hd., a.c. m.d., taper

24"x60" ctrs American Heavy Patt. Grd. Hd., a.c. m.d., taper

36"x96" ctrs Schumacher & Boye Triple Grd., cone, taper

36"x120" ctrs American Grd. Hd., a.c. m.d., taper

MILLING MACHINES

No. 4 Cincinnati High Power Vertical, a.c. m.d.

No. 26 Van Norman Universal, new 1943

No. 4 Cincinnati High Power Universal, a.c. m.d., div. hds.

No. 4-B Brown & Sharpe Heavy Plain

No. 1224 Milwaukee Simplex, late type

GRINDERS

10"x18" Norton Plain, a.c. m.d.

10"x24" Landis Plain Self-contained, a.c. m.d.

10"x48" Landis Type C Plain Hydraulic, late

No. 13 Brown & Sharpe Universal & Tool, late

No. 49-53" Besley Vert. Spindle Disc

No. 81 Heald Internal, chucking, Size-matic, Gage-matic

PLANERS

30"x30"x8' Cincinnati, a.c. m.d.

36"x36"x10' Cincinnati, a.c. m.d., box table

42"x42"x14' Niles-Bement Pond Heavy Patt., d.c. m.d.

42"x42"x16' Gray, arr. m.d.

MISCELLANEOUS

200-ton Niles-Bement-Pond Hydr. Wheel Press

36" Morton Draw-Cut Shaper

6' x 3/8" Kling Bending Rolls

EF Cleveland Punch & Shear, 1¼"x1", 48" throat

No. 7 Fellows High Speed Gear Shaper

Model A-3-6 Sturdybender Press Brake, a.c. m.d., 8'x12 ga.

7"x7" Peerless "Mechani-Cut" Saw, a.c. m.d.

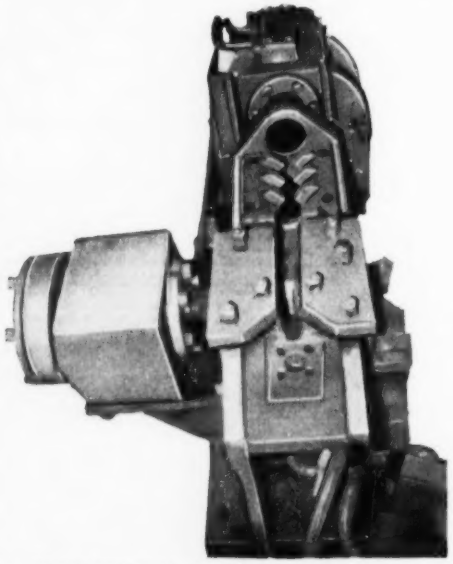
Many other machines in stock. Send us your inquiries.

COX MACHINERY COMPANY, INC.

3 MINUTES FROM THE CINCINNATI HOTEL DISTRICT

P. O. BOX 1953 CINCINNATI 1; OHIO

Office&Warehouse 311-313 Bakewell St.,Covington,Ky.



3—BILLET PIERCERS—Hydraulic for 1200 PSI Service (less pumps) for Inserting Porter Bar in Forging Blanks.

1—TOLEDO H165 DOUBLE ACTION PRESS 14" Stroke, 27½x32" Bed, 125 Ton Capacity. Rebuilt.

1—CLEARING KNUCKLE JOINT PRESS K-1200, 200 Tons, 4" Stroke, 1" Adjustment, 30"x30" Bed-Like New.

1—COLONIAL BROACH Hydraulic Vertical Model VP-1—4 Ton Capacity—18" Stroke for Surface Broaching, Equipped with Shuttle Fixture for Semi-Automatic Work Cycle.

2—NATCO HOLEUNITS E9 Self-Contained with Mounting Base, 1½ HP Each Head.

6—PIPE THREADERS MERRELL MFG. CO. & D. SAUNDERS 1"-4"; 1"-6"; 4"-12"; 10"-18" Modern Landis Heads.

2—HALL PLANETARY THREAD MILLS (tooled for 90mm shells) Sacrifice Price.

2—TAYLOR-WINFIELD TYPE ENS—100 KVA Spot Welders—Press Type. 46,000 Ampere, 440 Volt. Late Type. 24" Throat. Special Price.

1—EXCELLO #724—8" Automatic Shell Turning Lathe. Hydraulic Cam Contour Turning.

1—INGERSOLL BORING LATHE, 18" Diameter Boring Bar with Milling Attachment, Serial No. 16571, 1943, Thoroughly Reconditioned. Complete with Automatic Control Panel.
Working length of boring bar 98⅝". Bar travel 125". Height of center line of boring bar over bed 24". Overall bed length 327". Boring bar length 110". Work bed 84"x127" with 3-2" tee slots. Spindle powered with 25 HP, 230 volt DC motor. Spindle speeds 6 to 47 RPM. Carriage feed. 375 to 17.6 inches per min. Rapid return—222" (18'-6") per min. 7-21" cutter heads.
Location: Seattle. Contact Us for Inspection and Special Price

1—METALWASH—4 stage all stainless steel, continuous conveyor, tunnel type—self contained—passivating machine consisting of rinsing station; passivating station (pickling); hot water rinse and hot blast drying zone—complete with pumps, adjustable speed drive for stainless steel roller chain, conveyor, tanks, etc. Opening 16 inches high by 72 inches wide.
Machine was used approximately one year, is in excellent condition—complete with all piping and ventilation equipment.
Ideal for passivating and pickling stainless steel and mild steel products continuously. Production figures on request. For sale at approximately ⅓ acquisition cost.

LURIA BROTHERS AND CO., INC.

LINCOLN-LIBERTY BLDG., PHILADELPHIA 7, PA. PH. RITTENHOUSE 6-7455

Att. MR. ARNOLD LANDESBERG

HILL-CLARKE MACHINERY COMPANY

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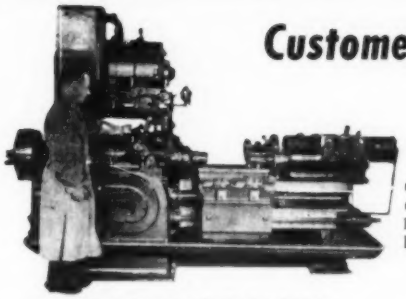


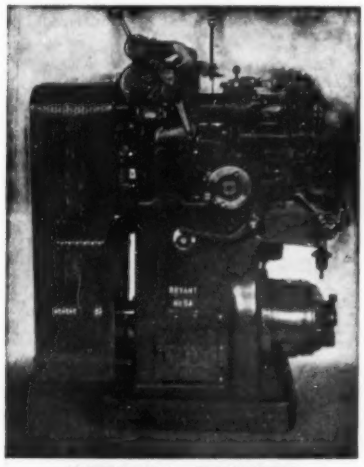
Model R14 Seneca Falls Lo-Swing
Automatic Lathe—16½" swing x 33" between centers. Hardways, front carriage with double slide. Back cutoff slide. Motor not included.

Customers Confirm··You're Always SURE with HILL-CLARKE

AUTOMATICS
1-1/16" Model A Cleveland (1942)

DRILLS
1 Spdl—14" Sw—No. 2 Avey Cam Fd.
1 Spdl.—26" Sw.—No. 2 LMS Leland-Gifford
1 Spdl.—30" Sw.—No. 4 taper Aurora
2 Spdl—24/ Sw—No. 3 Avey
12 Spdl. D-31 Fox, No. 2 Taper

GEAR MACHINES
No. 12HS Gould & Eberhardt Hobber
11" Gleason Bevel Gear Generator
No. 64 Fellows Gear Shaper
No. 36-BM G & E 3 Spdl, Rougher
No. 612-A Fellows Gear Shaper
No. 615-A Fellows Gear Shaper
No. 65 Fellows—Cone Dr.
8" cap Red Ring Gear Lapper



INTERNAL GRINDER
No. 5-B Bryant Internal Grinder
Swing 6½". Traverse 2¾". Recommended bore range ⅛" to 2", swivelling work head for taper. Inspect at our plant.

GRINDERS
6" x 18" Landis (1942)
6" x 18" Norton Cylindrical (1943)
10"x48" Norton type C (1943)
Hill-Clarke Cylindrical Grinders
10"x36" centers
10"x72" centers
18"x96" centers
24x32 Gap x144" centers
14"x36" centers 14"x72" centers
14"x96" centers 18"x96" centers
20"x96" centers
24"x264" centers
No. A-3—12" Arter Rotary Surf.
No. 1109 Bryant Internal Grd. (1951)
(9" swing—1" bore x 3¼" grind stroke)
No. 5 Bryant Internal Grd.
No. 5B Bryant Internal Grd.
No. 16-16 Bryant Internal Grd.
No. 16 A-16 Bryant Internal Grd.
No. 16-28 Bryant Internal Grd.
No. 16 A-28 Bryant Internal Grd.
No. 16 F-28 Bryant Internal Grd.
No. 24-26 Bryant Internal Grd.
No. 24-36 Bryant Internal Grd.
No. 81 Heald Centerless Internal
No. 74 Heald Internal Centerless

LATHES
16"x54" centers Monarch Toolmakers (1942)
16"x33" R-14 Seneca Falls Auto. Lathe
19"x8' LeBlond Hvy. Duty Lathe
27"x12' American Geared Hd. Lathe
36"x18' Putnam Grd. Hd. M.D.
5W Acme Ram type Tur., 2" Capacity
No. 6 Warner & Swasey Tur.-Bar Fd.
18" Libby Tur. Lathe, M.D.
No. 3AL Gisholt Cross-Slide Tur.
No. 4A Warner & Swasey—7¼" Hole—Spdl.

CONSULT US ABOUT REBUILDING YOUR OWN MACHINES

•

Your Worn Machines Can Be "NEW" AGAIN

•

HILL-CLARKE
Gives You the Finest Re-manufacturing Obtainable

MILLING MACHINES
No. 08 Cincinnati Vert. Mill (1942)
54"x30"x16' Ingersoll Slab Mill
6"x168" Pratt & Whitney Thrd. Mill
10"x48" Hanson-Whitney (1942)
10"x60" Pratt & Whitney Thrd. Mill
12"x102" Lees-Bradner Thrd. Mill

PLANERS
36" x 36" x 12' Cincinnati, 2 hds.
48" x 48" x 12' Cincinnati, 2 hds.
48"x36"x14' Gray, 2 hds.
60"x48"x27' American, 4 hds.

MISCELLANEOUS
1"-2" Dia. Cap. Micro. Hor. Hone—#200
¼"-1" Dia. Cap. Micro. Hor. Hone—#H-2
42"—18 gage Economy Power Shear
75 Ton R & K Straight Side Press
3 Ton Fox Hydraulic Press
2—12"x96" Magnetic Chucks
20'x1" cap Southwark Roll
15" Dill Slotter
18" Dill Slotter
38" Morton Draw-Cut Shaper (1945)
No. 0 Bakewell Tapper

No. 2 AVEY CAM FEED DRILL
for long run production; 1½ HP AC Motor, 14" Swing, distance Spindle to table 31".

FULL MONEY-BACK GUARANTEE

1. Hill-Clarke always give you an unconditional money-back guarantee.
2. All machines in stock.
3. You can see your machine run and tested under power in our plant before purchasing.
4. Complete and modern facilities plus experienced craftsmen for REMANUFACTURING machine tools in our 58,000 sq. ft. plant.
5. A responsible organization—established 1867

Write, Wire or Phone **HILL-CLARKE MACHINERY COMPANY**
651 WASHINGTON BOULEVARD, CHICAGO 6, ILL. PHONE CEntral 6-0500

We Sell GUARANTEED PERFORMANCE

These Are Some of The Like New Machine Tools We Have Immediately Available.

LATHES
No. 8 SUNDSTRAND Stub, 1941
No. 12 GISHOLT Automatic
14x30 MONARCH, 1936
14x54 MONARCH, 1937
16x102" REED PRENTICE, 1941
18x48 MONARCH Ser. #16075, 1942

PRESSES
No. 50-5½-84, 48x48 Platen, 105 Ton
No. 25K BLISS Kunckle Joint 24x24 Platen, 600 Ton

MILLS
No. 2 CINCINNATI, Univ., HSDT, 1943
No. 2 CINCINNATI Vert., HSDT, 1943
No. 3VG REED PRENTICE (2
No. 0B CINCINNATI Vert., Rotary Table
No. 1-12 CINCINNATI
24"x36" INGERSOLL DUPLEX, 1942
No. 3-36 CINCINNATI Production
No. 4-48 CINCINNATI Production
No. 12 BROWN & SHARPE Production

We Have A Million Dollar Inventory. Send Us Your Requirements for Fast Service.

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All equipment purchased from Joseph Behr & Sons, Inc., must perform to your requirements. We guarantee that performance!

From our huge inventory of machine tools comes the equipment you need. Our complete rebuilding shop certifies the ability of the machine you buy to perform to your needs.

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COMPLETE ELECTRICAL SHOP SERVICE
Repairing, Rebuilding, Rewinding, Loans, Motors, Controls, Magnets, Transformer . . . Everything!

JOSEPH BEHR & SONS, Inc.
1218 Seminary St. Rockford, Illinois

LATE MODEL MACHINE TOOLS . .

AUTOMATICS
No. 656 New Britain Chucker, 1943.
1½" 6 Spdl. Cone Automatic, 1941.
2" Model A Cleveland, 1941.
1-1/16" Model A Cleveland, 1943.
No. 00G Brown & Sharpe, 1941.

BOREMATICS
No. 2112 Excello Single End, Late.
No. 40 Heald Double End, 1942.

BROACHES
HP-100 La Pointe Horiz. Broach, 1945.

DRILLS
Ma-6 Avey 4 Spindle, H.F. 1943.
Allen Single Spindle Drill & Tapper, 1942.
No. 2 LMS Leland-Gifford H.F. 1942.

GEAR EQUIPMENT
No. 7 Gleason "Revex" Rougher, 1943.
No. 6 Gleason Revacycle Generator, 1940.
No. 72 Fellows H.S. Gear Shaper, 1942.
10" Pratt & Whitney Hyd. Gear Grinder, '42.

GRINDERS, CYLINDRICAL
10"x18" Norton Plain Type "C", 1940.
6"x30" No. 12 B & S Hydraulic, 1940.
No. 2 Cincinnati Centerless Grinder, 1944.

GRINDERS, INTERNAL
No. 72-A3 Heald Plain Hydraulic, 1942
No. 24-36 Bryant Hydraulic, 1943.
No. 16A2B Bryant Hole & Face, 1942.
No. 16 CP 16 Bryant Hydraulic, 1942.
No. 16-16 Bryant Hydraulic, 1942.
No. 172 Heald Hydraulic, Gap, 1940.

GRINDERS MISCELLANEOUS
No. 18A Blanchard Auto. Surface, 1942.
Cincinnati Centerless Lapper, 1942.
SG-11 Geargrind Spline Grinder, 1942.
HRS Barber-Colman, 1942.

GUN BARREL MACHINES
No. ½ B x 50 P & W Reamer, Latest.
No. ½ B x 30 P & W Reamer, Latest.
No. ½ B x 50 P & W Rifler, Latest.

LATHES, ENGINE
27"x192" Niles Timesaver, 2 Carr, 1941.
27"x96" Niles Timesaver, 1940.
26"x180" Betts Bridgeford, 1940.
26"x96" Betts Bridgeford, 1940.

LATHES, PRODUCTION
8"x84" Lo-Swing Semi-automatic, 1941.

LATHES, TURRET
36" Bullard VTL, Spiral, Late.
No. 2A Warner & Swasey Saddle Type, 1940.
No. 1A Warner & Swasey Saddle Type, 1941.
No. 1L Gisholt Saddle Type, Late.
No. 3R Gisholt Universal Saddle Type, 1943.
No. H5 Libby Universal Saddle Type, 1939.
No. 5 GISHOLT Universal Ram Type, 1942.

MILLS, PRODUCTION
No. 1848 Milwaukee Duplex, 1942.
No. 2-18 Cincinnati Automatic, 1942.
M-18 Milwaukee, 1943.
No. 3 Cincinnati Univ. Dial Type.
No. 0B CINCINNATI Rise and Fall, 1942.

MILLS, TOOL ROOM
No. 3 Van Norman Plain, 1942.
No. 22L Van Norman Plain, 1943.
No. 2 Saimp Vertical New.
No. 2 Saimp Universal, New.
No. 3 Saimp Plain & Vertical, New.
No. 4 Saimp Vertical, New.

SHAPERS
32" Ohio Heavy Duty Univ. 1951.
16" Gernetti Universal Shaper, New.
20" Gernetti Universal Shaper, New.
24" Gernetti Universal Shaper, New.

Partial Listing — Write for latest stock list

INDIANAPOLIS Machinery & Supply Co.
1961 S. Meridian St. • • Indianapolis, Indiana

30"x16' bed AMERICAN High Duty Geared Head Lathe
42"x15' AMERICAN Heavy Duty Lathe
42"x25' centers AMERICAN Heavy Duty Lathe
No. 172 HEALD Gap Internal Grinding Machine for large swing
6"x18" LANDIS Type C Plain Grinder
10"x72" LANDIS Type C Hyd. Pl. Grinder—1942
Nos. 4D and 6S POTTER & JOHNSTON Automatic Lathes
No. 9A JONES & LAMSON Saddle Type Universal Heavy Duty Turret Lathe
No. 0-S CINCINNATI Plain Milling Machines
No. 2M CINCINNATI Vertical Miller, 1941
No. 1-18 CINCINNATI Plain Mfg. Miller
No. 12 B&S Plain Bed Type Production Miller
6"x60" P&W Model C Thread Miller
36"x36"x12' INGERSOLL Planer Type Milling Machine—3 heads—late
Type A BARBER-COLMAN Gear Hobber
No. 04 FELLOWS Gear Shaper
No. 72 FELLOWS High Speed Gear Shaper
No. 12 FELLOWS Gear Shaver, 1943
No. 36BM GOULD & EBERHARDT Gear Rougher
16/20" GOULD & EBERHARDT Industrial Shaper
100" BETTS Vertical Boring Mill, 2 heads
No. 0G B&S High Speed Automatic Screw Machines.

WIGGLESWORTH INDUSTRIAL CORPORATION
203 Bent St., Cambridge 41, Mass.

FOR SALE

1—Production Air Tracer Lathe, 13"x42" Monarch Monamatic with 15 hp motor, 1800 rpm, serial #MM31848-AT, purchased in February 1949. New machinery guarantee. Fully equipped.

1—Heald Sizematic, completely rebuilt by the Heald Machine Company within the last 90 days, serial No. 6887.

FS-8049, AMERICAN MACHINIST
330 W. 42nd St., New York 36, N. Y.

1941-1953 MACHINE TOOLS

IMMEDIATE DELIVERY — NO PRIORITIES NEEDED

CAM MILLERS

VAN NORMAN: 10CT Contour Miller, horizontal opposed spindle type for milling flat cams, also can be converted to similar work

CENTERING MACHINES

SUNDSTRAND: 44" Double End Centering Machine

CUTTER & TOOL GRINDERS

FELLOWS: Flat Top Helical Gear Cutter Grinder
OLIVER: 10" Template Tool Bit
RANSOM: 2-Wheel Grinder 3 HP
RUSSELL: 40" Saw Sharpener (New) automatic indexing

DRILLING MACHINES

ALLEN: #2 High Speed, 15" overhang
PRATT & WHITNEY: ½B x 50 Deep Hole Drilling & Reaming Machine, 2-spindle
SUNDSTRAND: 44" Double End Centering Machine

GEAR CUTTING MACHINES

BROWN & SHARPE: No. 6 Gear Cutter, 72" diameter, 1¾ D. P. capacity
CLEVELAND: Model 130 Gear Hobber (like new)
CLEVELAND: Model 140 Gear Hobber (like new)
FELLOWS: 61A Shaper, 18" dia.
FELLOWS: 64A Shaper, 18" dia.
FELLOWS: 72 Shaper, 7" dia.
FELLOWS: Flat Top Helical Gear Cutter Grinder
FELLOWS: Straight Line Generator, 3" dia. with many cutters
GLEASON: #12 Rough & Finish Gen.
GLEASON: 3" Straight Bevel Gear
SYKES: Gear Shaper 14" external, 20" internal (New)
SYKES: Rack Cutting Machine 12" to 36" length capacity (New)

GEAR AND SPLINE GRINDERS

PRATT & WHITNEY: 10" single and double wheel, hydraulic feed
GEAR GRIND MACH: GG-19, 10"x 24" Hydr. Spur Gears and Splines

GEAR FINISHERS & TESTERS

FELLOWS: 8 LSI and 13 LSI Gear Lappers, external and internal spur and helical
FELLOWS: #12C Cone & Spacing Inspection Instrument
GLEASON: No. 4 and No. 6 Bevel Gear Testers. Hand and Power
NATIONAL BROACH: SIC-12" Red Ring Gear Testing Machine

GRINDERS—CYLINDRICAL

BROWN & SHARPE: No. 10 capacity 6"x18" plain
CINCINNATI, 6"x18" Hydraulic, Plain

3-WAY GUARANTEE

1. Should any machinery purchased from us prove unsatisfactory, you can return the machines within 30 days, via freight prepaid to our plant, and a full refund will be made.
2. Machines at our plant can be demonstrated and tested under power before purchasing.
3. You are dealing with a well-established, highly-rated firm of machinery engineers with over 33 years of proven responsibility.

LANDIS: 16x32" Type "D" Crankpin, hydraulic, for grinding crankshafts
NORTON: 10"x18" 45° angle wheel

GRINDERS—GEAR & SPLINE

GEAR GRIND MACH.: GG-19, 10"x 24" Hydr. Spur Gears and Splines
PRATT & WHITNEY: 10" single and double wheel, hydraulic feed

GRINDERS—INTERNAL

BRYANT, 16-16 Internal Hydraulic
BRYANT: No. 5Y Internal
HEALD: 72A3 Sizematic Centerless

GRINDERS—RADIUS

VAN NORMAN: #73, capacity 7½"
VAN NORMAN: #639, capacity 7"
VAN NORMAN: #649, capacity 6" to 16" diameter
VAN NORMAN: #3½ Un. Radius

GRINDERS—THREAD

EXCELLO: #31 External, dia. 5"x18"
JONES & LAMSON: #636 Universal, 6" dia. x 36" centers and one extra multiform wheel dressing attachment

HONING MACHINES

MICROMATIC: H-510 Double End Horizontal, ¾" to 2" dia.
MICROMATIC: H-2 Single End Horizontal, 2-spindle, ¼" to 1" dia.

LAPPING MACHINES

FELLOWS: 8LSI and 13 LSI Gear Lappers, external and internal spur and helical

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BLOUNT: Polishing speed lathe 12" dia. x 48" centers
H.E.B.: High production hydraulic duplicating and copying lathes (new)
LODGE & SHIPLEY: #3A Duomatic. 25½" swing x 27" centers
POTTER & JOHNSTON: #6 DREL Automatic
New Engine Lathe 27" swing x 23' centers

LATHES—TURRET

WARNER & SWASEY 1A & 2A Turret Lathes
WARNER & SWASEY #3, #4 & #5 Turret Lathes
HERBERT: #2, #4, #7, and #8 Sizes (new)
WEBSTER & BENNETT: Vertical Turret Lathes 36" & 48" (New)

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TAYLOR-FENN: M-80 Duplex Spline
RICE-BARTON: Duplex Spline
VAN NORMAN: 10CT Contour Miller, horizontal opposed spindle type for milling flat cams, also can be converted to similar work

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CAMPBELL: No. 425 Cutalator Abrasive Cut-Off, 4½" dia. capacity
MOTCH & MERRYWEATHER: No. 3 Circular Saw with auto. stock feed
RUSSELL: 9½" cut-off Saw with Auto. Stock Feed (New) Hydraulic
RUSSELL: 5½" dia. cut-off saws, auto stock feed, hydraulic (New)

THREAD MILLERS & TAPPERS

HALL PLANETARY: Model "D" Thread Miller
LANDIS: 2½" single head horiz. threading machine
LEES-BRADNER: #40A Thread Miller
LEES-BRADNER: CT-36 Thread Miller chucking type, 13½" hole.
MURCHEY: #22 Horizontal threading and tapping machine, ⅛" to 2½" dia. capacity, single spindle
NATCO: Vertical Tapper 16 spindle

WIRE FORMING MACHINES

BAIRD: 4-slide wire former
HEENAN & FROUDE: Wire forming, 4-slide machines (new)

MISCELLANEOUS

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CUTOFF: Campbell, abrasive 425 Cutalator 4½" dia. Capacity
RACK CUTTING MACHINE: Sykes 12" to 36" length capacity (New)
CUT-OFF: Russell 5½ & 9½" cut-off saws with auto. stock feed (new) hydraulic
TEST STAND: Denison 918-AM Hyd.
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24" Bullard Spiral Drive Vertical Turret Lathe—1942

100" Betts Heavy Duty Vertical Boring & Turning Mill

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6"x18" Landis Type C Plain Cylindrical—Plunge Cut—Automatic Cycling

6"x30" Norton Semi-Automatic Plain Cylindrical — Hydraulic Rapid Infeed — reciprocating spindle

10"x36" Landis Type C Hydraulic Cylindrical—1941

14"x36" Norton Type C Cylindrical—Hydraulic Plunge—1943

#81 Heald Plain Chuck Type Internal—1941

#73 Heald Airplane Cylinder & Sleeve—1942

12"x36" Norton Type "L" Universal—1941

10"x24" Landis Type C Hydraulic Universal—1939

#186-30" Gardner Horizontal Disc—1939

#95-110" Bridgeport Face Grinder—1943

LATHES

12"x30" Model C Monarch Geared Head Toolroom—1940

14"x30" Reed Prentice Sliding Gear Head Engine—1939

16"x48" Bradford Geared Head Quick Change—1940

MILLERS

#10 Brown & Sharpe Plain—1941

18" Cincinnati Plain Manufacturing Type—1941

#2H-24" Milwaukee Manufacturing Type—1940

#1218 Milwaukee Simplex—1941

#1854 Milwaukee Duplex—1942

FV5MZ Skoda Vertical—Table 31"x91⅜"—1942

4½"x12" Model C Pratt & Whitney Thread Miller

6"x36" Model LT Lees Bradner Thread Miller—1940

PRESSES

#59 Niagara Single Crank, single geared, Straight Side, Tie Rod, Bed 31"x27", stroke 3"

200 ton HPM Fastraverse Double Action—Stroke 18"—bed 48"x48" New 1944

TURET LATHES

#3 Gisholt Universal—1942

#4 Gisholt Universal—Bar feed—preselector head—1940

#1L Gisholt Universal—saddle type—1942

#2L Gisholt Universal Saddle Type—1941

#1 Warner & Swasey Electric Head—1944

#1A Warner & Swasey Saddle Type—Bar Feed—1939

#2A Warner & Swasey Saddle Type—Bar Feed—1941

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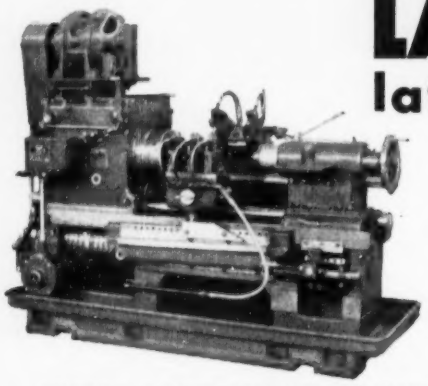

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18" x 72" LANDIS Universal Hydraulic Cylindrical Grinder
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#1 (⅝" bar) WARNER & SWASEY Electric Head Ram-type Turret Lathe
72A3 HEALD Gagematic Internal Grinder
72A5 HEALD long base Internal Grinder with cam follower copying attachment

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Bridgeford H.D. Quick Change Geared Head Engine Lathe, 36"x16'

Gisholt Vertical Turret Lathe 48"

Baush Drilling Machine, 2 Ways, 2 Spindle D.E. Horiz. Deep Hole Driller, 2" dia. capacity, bed 10'8" long

Baush Mult. Drill Press. Cap. 30 drills, 36"

Vertical Miller, Table 18"x60"

Hydraulic Planer 36"x36"x16'

N.B.P. Planer 48"x60"x15'

Ultra Lap with 10" dia. table

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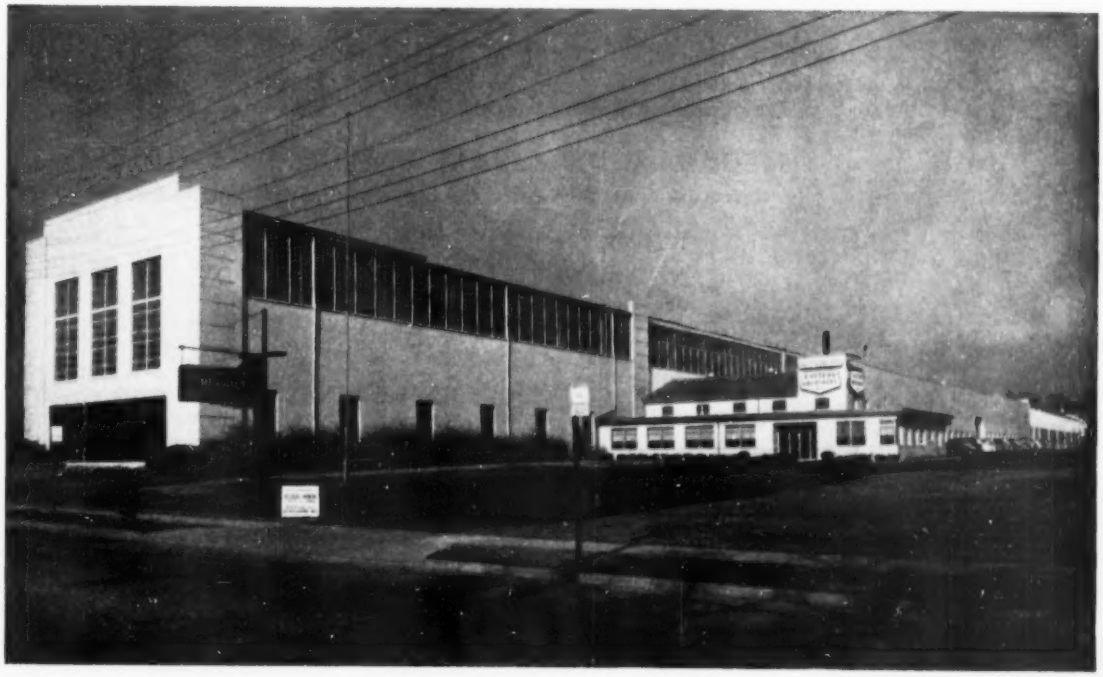

AUTOMATICS

9/16" Acme, m.d.
7/8" Cleveland Model B, belt
1" Acme, m.d.
1 1/2" Cleveland Model A, belt
4 spindle 1 1/4" Conomatic, m.d., bar, 1942 machine
No. 5D Potter & Johnston, m.d.
No. 6A Potter & Johnston, m.d.
No. 6C Potter & Johnston, m.d.
14" Fay Flanders Type, m.d.
4 spindle 2 1/4" Cleviand Model "K", m.d.
No. 8A Cleveland, m.d., 8" cap., latest

BOLT THREADERS

Victor Nut Facing Machine, m.d., cap. 3/8" to 2" nuts
1" Landis Double Spindle, m.d. thru gear box
1 1/2" Landis 2 spindle, late
1 1/2" Landis 2 spindle, older type

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Barrett Double End, 5" and 7" spindles, m.d.
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6" bar Newton No. 2 Cylinder Borer, m.d.
7" bar Niles-Bement-Pond, m.d.
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Pair tables for use on Floor Type Horiz. Boring Mill, 8' long x 15 3/4" wide x 33" high, 2 T slots
54"x11' Rectangular Table, 40" high

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36" Bullard New Era, m.d., p.r.t.
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42" Bullard New Era, m.d.
42" King, m.d.
44" Putnam, m.d., p.r.t.
44" Niles, m.d., p.r.t.
52" King, m.d.
53" Niles Heavy Pattern, m.d., p.r.t.
73" Niles, m.d., p.r.t.
100" Niles Heavy, m.d., p.r.t.
12' Niles, m.d., p.r.t.

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75 H.P. LaPointe Hydraulic Broach, m.d.
Cincinnati Mill Broach, m.d., 10" spindles, new
12x72" Thompson Automatic Flat Broach, m.d.

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3'-13" col. Cincinnati-Bickford Super Service, m.d.
3 1/2'-9" col. Cincinnati-Bickford Plain, m.d.
4'-17" col. Dreses, gear box, m.d.
5'-13" col. American, gear box, m.d.
7'-16" col. American Triple Purpose, m.d.
8'-17" col. Dreses, gear box, m.d.
8'-19" col. Cincinnati-Bickford Super-Service, m.d.
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Doty Mfg. Co. 6' Pyramid Type Bending Rolls
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Gray Turret Head Metal Cutter, cap. 1/4", 16" throat
No. 2 Libert Nibbler, 28" throat
120" No. 100 Niagara Heavy Production Folder, 16 gauge, m.d.
No. 3—3/4" cap. Gray Sheet Metal Cutter, m.d.
8'x1/2" cap. No. 188 Dreis & Krump Leaf Brake, m.d.
No. 336 cap. 3/8" W. J. Savage Co. Nibbler
Pels Combination Ironworker, m.d.

TURRET LATHES AND SCREW MACHINES

No. 601 WD Oster Geared Head Rapiduction, m.d. in leg, chucking
No. 1 Warner & Swasey, bar, m.d.
No. 1A Warner & Swasey, m.d.
No. 1, 2 Cincinnati-Acme Full Universal, m.d.
No. 2A Warner & Swasey, m.d., bar
No. 2F Foster Fastermatic, m.d., Timken
No. 2H—27" swing Libby Turret Lathe, m.d., later type
No. 3 Cincinnati-Acme Full Universal, m.d., chucking
No. 3 Foster Geared Head, m.d.
No. 3F Foster Fastermatic, m.d., Timken
No. 4 Warner & Swasey, cone, bar and Chucking types
No. 4A Warner & Swasey Universal, m.d., chucking
No. 4FU Foster Fastermatic, m.d., latest
#5 Gisholt Full Universal type Turret Lathe, m.d., late type
No. 7 Bardons & Oliver, cone
5/8" Pratt & Whitney Hand Screw Machine, cone, bar
2 1/2x24", 3x36", 3 1/2x32", 4x34" Jones & Lamson Geared Head, m.d., bar and chucking types
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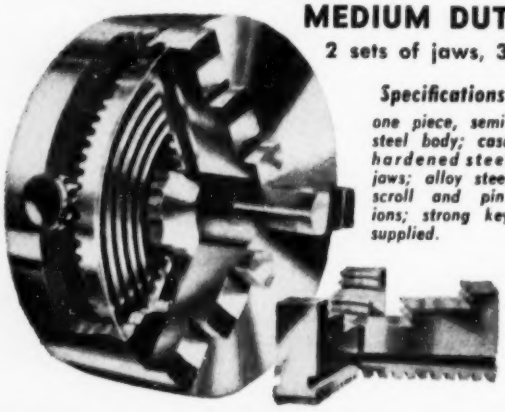

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7½"	29	57.50	13.50
9"	42	67.50	15.00
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MILL: K&T M18 Simplex Mill. Serial No. 274236.

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#2 Warner & Swasey Electric Turret Lathe. Late model.

4"x12" type H Landis Cylindrical Grinder. 1944.

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Worthington duplex Air Compressor. 665 CFM, 125 h.p. Very little use.

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Cleveland Model B. Serial #42618/843
Conomatic 4 Spindle, Serial #2309FF, 1½"

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Bullard 24" V.T.L., Spiral Drive
Bullard 8'—8 spindle, Multi-Matic
Cleveland 2½" Bar Capacity
Giddings & Lewis #32, 3" #25, 2½" Bar
Kings 42", 72" Vertical 2 rail heads
Niles-Bement-Pond 4", 4½" Bar, 60" Vert.
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New 3" Horizontal Boring Mill

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Bausch Multi-spindle
Buffalo #2 Motor Spindle, #16—4 Sp.
Buffalo: Power No. 41, No. 42
Canedy-Otto 21" Sliding head New
Cincinnati Bickford 6'x15" col.
Edlund 8" Model 2B, Sliding Head
Natco #12 20 spindle drill
24" Sibley Sliding head
New Geared Box Col. Drills 24'
Foote-Burt #25 3" capacity
Leland Gifford 2 LMS, 3 MS
Leland Gifford No. 2—4 Sp. Hyd. Feeds
Sigourney 2 spindle

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Taylor-Hobson 3 dimensional Pantograph

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Barber-Colman #2, #12 (3)
Barber-Colman Hobber Type S
Brown & Sharpe #3 Gear Mill, 26" Cap.
Fellows High Speed Shapers 712, 725, 71, 7
Fellows #20M Redliner, Flather 72" Cutter
Gleason #2 Surface Hardener, No. 3 Gear Tester
Gleason #3 Spiral, #3 Straight Bevel
Gould & Eberhart 36" Cutter
Michigan Gear Finisher 24" cap., 862-24A
Mikron No. 79 Gear Hobbers
National Broach Red Ring Lapper, Finisher
Schuchardt & Shutte #1 Hobber

GRINDERS, SURFACE
New 9x24" Hyd. Feed, 10x18", 6x18"
Abrasive 8x24", #33 Vert. & #34
Blanchard #16, 24" Mag. Chuck
Brown & Sharpe #5, #2 with Chuck
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800 Ton W&S Hobbing Press

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Brown & Sharpe #5, 3"x18" Cylindrical
Brown & Sharpe #13 Universal Tool & Cutter
Bryant #5 Internal, chucking
Cincinnati 6x18" Hyd. #4—Centerless
Gardner Disc Grinder 30"—15 H.P. Motor
Grenby Models 1G1 & 1G2—Internal
Gorton Ped. Type Tool Grinder Mod. 375-2
Heald #73 Internal Centerless, Sizematic
Heald 72A3 Int. Centerless Sizematic
Landis 6"x30" Type C Cyl., 10x24 Univ. 12x30
Norton #2 Tool & Cutter
Norton Type C 6"x18" Semi-Automatic cyl.
Norton 10"x18" Type C cylinderical
Norton 14"x96" cyl., 16x48 Univ.
Norton Roll Grinder 50"x28'
Oliver #510 Drill Pointer
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LATHES
American 14"x30", Bridgeford 36"x20", 32"x16'
Boyes & Emmes—24" Geared Head
Bradford 16"x36"
Gisholt Simplimatic 18"x16½, 2 Tables
Hendey 12"x42" and 12x30", 1941, 14" Yoke
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Kent Owens IV, 1-8, 1-14, 1M
Kempsmith #1 Pl., Vert. & Div. Hd.
Milwaukee 2H Universal
Milwaukee #2B, Plain & Univ.
Sundstrand #00, 0, Rigidmils
Sundstrand #3A Rigidmil with copying Attach, 33
Van Norman #2L Univ., Dividing Head

MILLS, VERTICAL
Cincinnati 2 Spindle Hydromatic
Cincinnati (2)—1-1B Plain Automatic
Cincinnati #3, #4 hi-power, 08 Vertical
Cleveland No. 1, table 8"x32"
Gordon 8D Super Speed
Morey #12M Profiler, 2 sp. #2 Maximiller
Reed Prentice Vert. Mill & Die Sinker Mod. 3VG

PRESSES
Bliss No. 1 Double Action Drawing Presses
Bliss 650 Hi-Production Presses
Bliss 18, 19, 21, OBI, 58, 62, 162, OB
Bliss 4½ Double Action, Roll Feeds, Cam (2)
Bliss #78½, 330 Ton SS, Bliss 74½
Bliss 5-48 Dbl. 32x48" bed, Cushion
Hamilton 850 Ton S.S. Bed 27x48
Hamilton 110 FM Die Tryout Press
New 85, 60, 55, 30, 20, 15, 10, 5 Ton O.B.I.
Niagara Herning, 15 Ton—Toledo 32 Ton Herning
Niagara A1¾, O.B.I., Niagara No. 27
Stokes Tablet Press, type R, Late, Model F
Toledo 92½c Double Crank 43x23" bed
Toledo 29 Double Action Cam
V. & O. #102 O.B.I. Reducing
Walsh No. 3 O.B.I. 23 Ton, L1 #3
Z & H #4½, O.B.I. 20 Ton

TURRET LATHES
Bardons & Oliver #2, 5, 7, Bar Feed
Brown & Sharpe, #2 Hand, #10, 11
Foster #2B 2½ Cap. Morey #2G Late
Gisholt 2L, Cross Slid. Tur.
Gisholt #5, Bar Feed, Plenty of Tools
Gisholt 4R—9¼" hole in spindle
Libby 1 HS with threading att.—3R, 4R
Oster 601 WD. #2 Simmons Microspeed
Warner & Swasey #1, 1A, 2, 3, 4, 5

MISCELLANEOUS
Band Saw: New Kalamazoo & Johnson
Bolt & Pipe Threader: Landis, Oster-Williams
Broach: New 6 Ton, Horizontal, 11 Ton, Vertical
Hacksaw: Peerless 6"x6", Racine 6"x6"
Jig Borers: New Swiss
Keyseater Davis, Baker
Pipe Bender, Kane & Roach, Vari-drive
Planer: Niles-Bement-Pond 36x36'x10'
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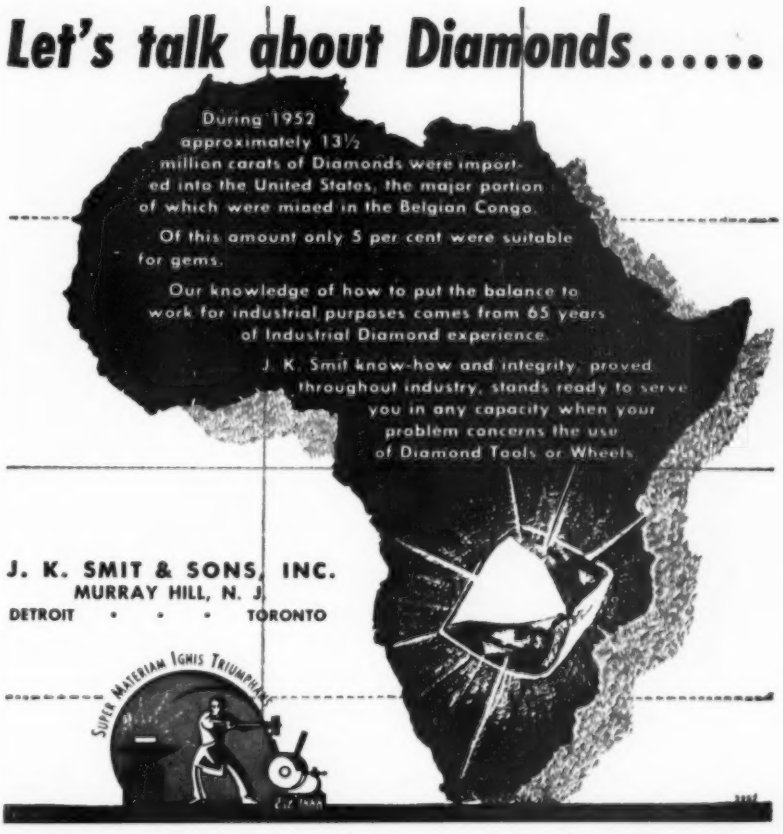
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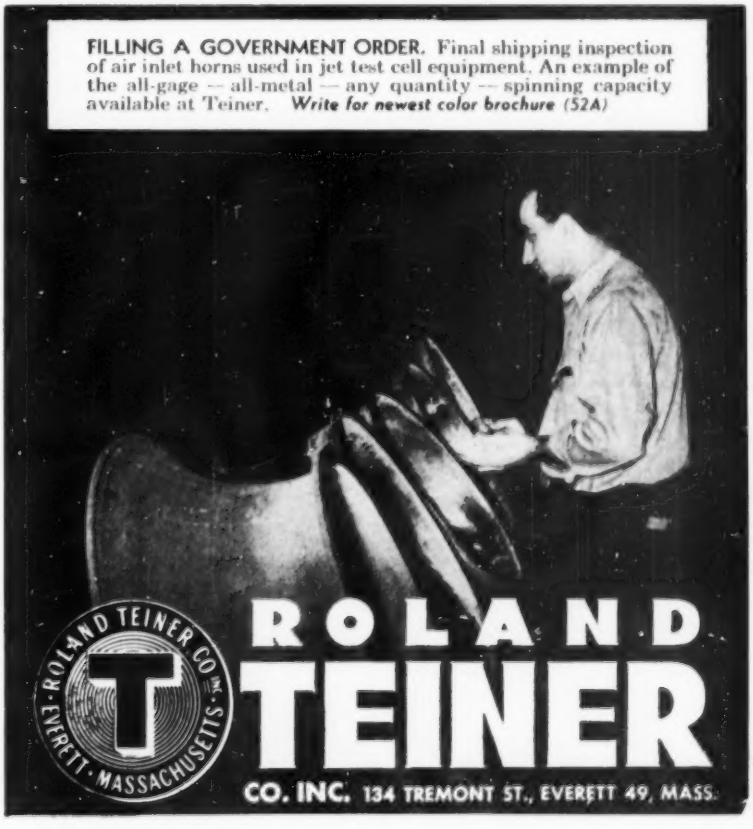
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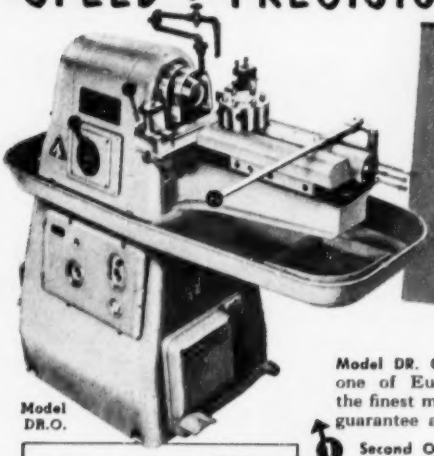

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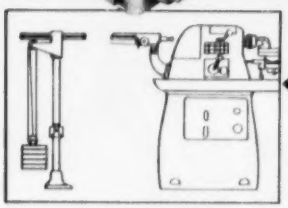

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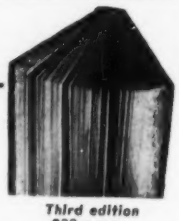

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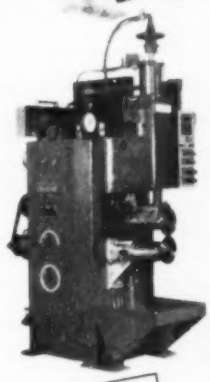

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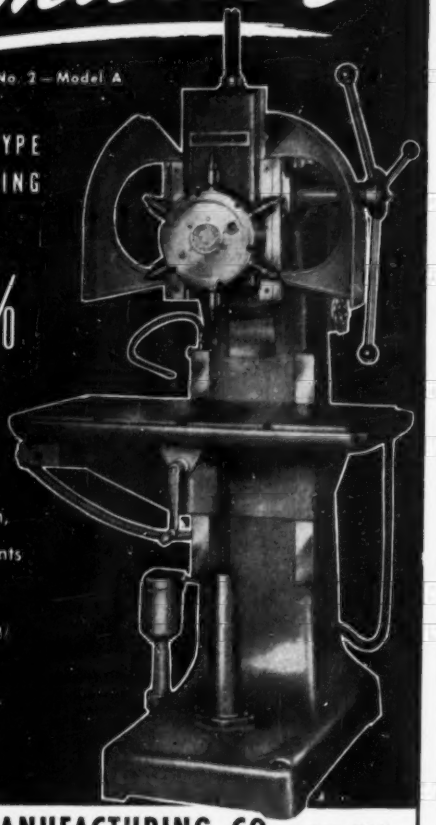

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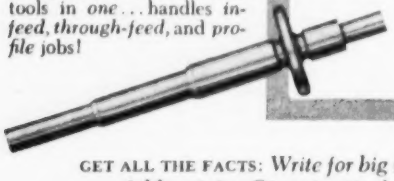

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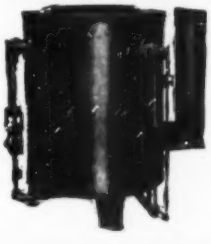

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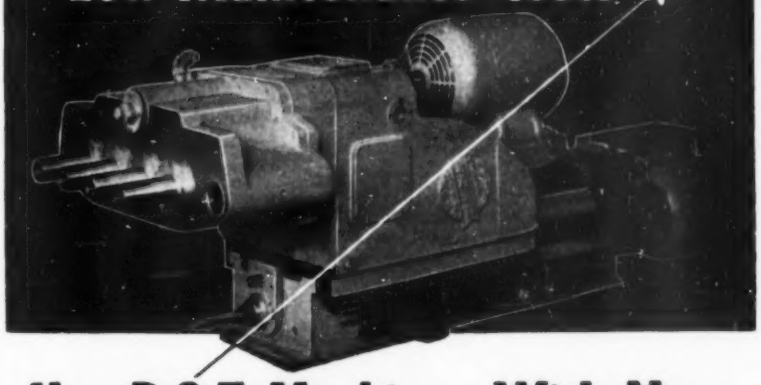

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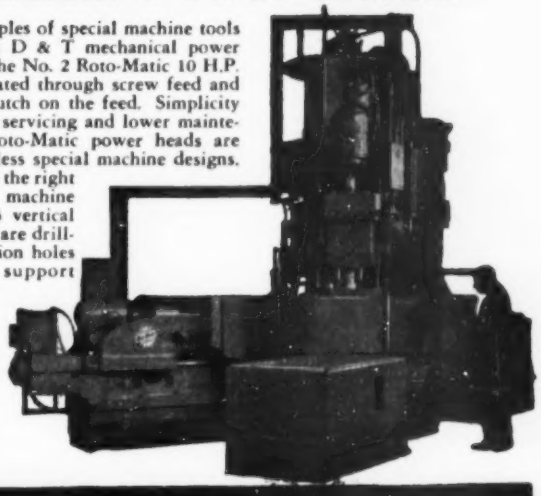

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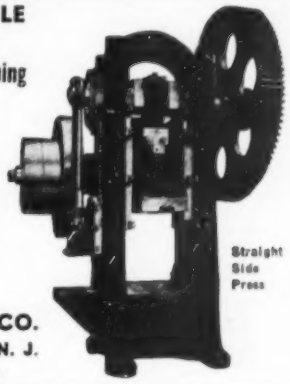

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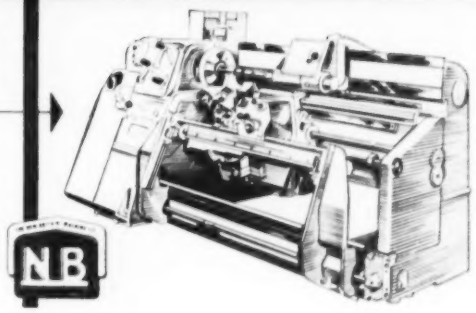

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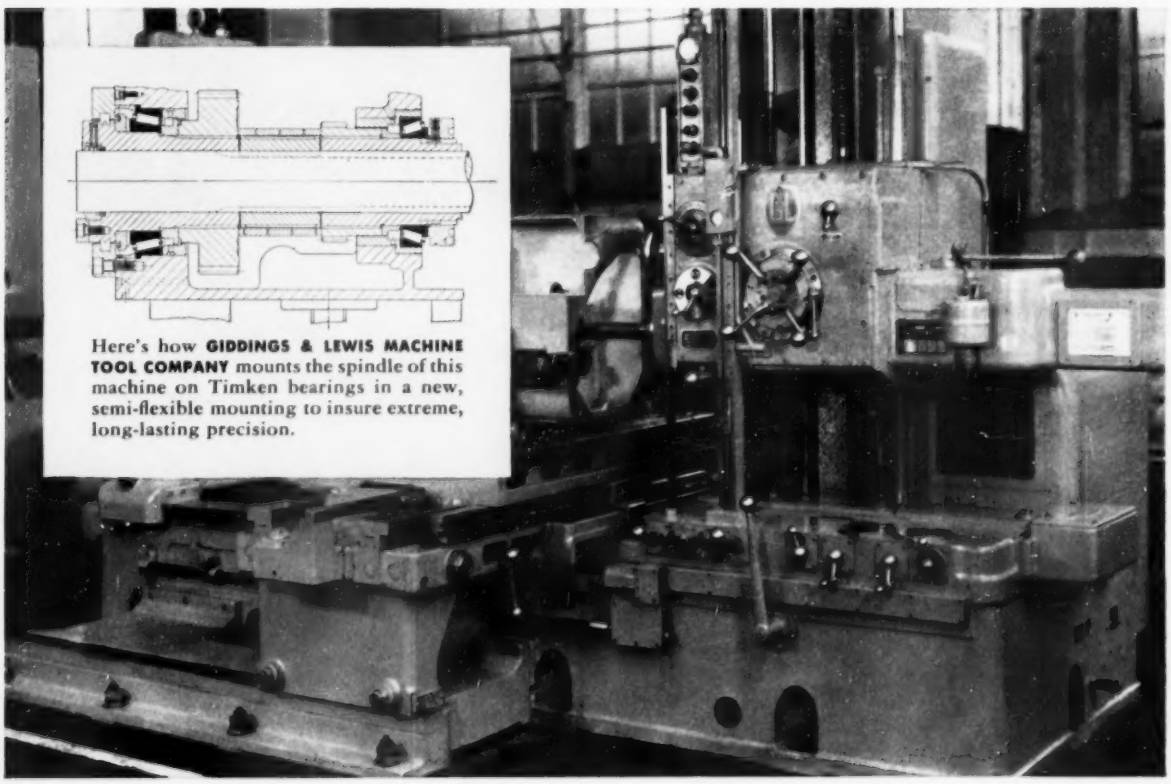

Here's how **GIDDINGS & LEWIS MACHINE TOOL COMPANY** mounts the spindle of this machine on Timken bearings in a new, semi-flexible mounting to insure extreme, long-lasting precision.

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